SOIL VAPOR EXTRACTION
PILOT STUDY REPORT
VERSION 3.1
MOTOR POOL AREA
ROCKY MOUNTAIN
ARSENAL

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Prepared for U.S. Department of the Army Corps of Engineers, Omaha District Omaha, Nebraska March 1992



Woodward-Clyde Consultants 101 S. 108th Avenue Omaha, NE 68154

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1.0 INTRODUCTION

This Soil Vapor Extraction Pilot Study Report for the Motor Pool Area at the Rocky Mountain Arsenal (RMA) is being prepared as part of the Interim Response Action (IRA) process in accordance with the Federal Facility Agreement and the Technical Program Plan. Determinations concerning the implementation of this IRA have been reached through a consideration of the objectives of Sections 2.3(a), 22.5, and 22.6 of the Federal Facility Agreement and by application of the Decision Flow Chart for Other Contamination Sources IRAs adopted by the Organizations and the State in the June 7, 1989 Subcommittee meeting (WCC 1990).

An alternatives assessment was conducted as part of the IRA process in the fall of 1989. The recommended action at the Motor Pool area was to address contaminated soil with in situ soil vapor extraction and to address contaminated ground water through the use of a pump and treat system in conjunction with a Shell-led IRA which addresses a dibromochloropropane plume emanating from the rail classification yard. This document presents the results of the Soil Vapor Extraction (SVE) Pilot Study conducted between July and December, 1991 at the Motor Pool Area.

An Implementation Document was finalized in February, 1991 which outlined the pilot study plan for soil vapor extraction in the Motor Pool Area. The primary objective of this program was to collect data on the performance of SVE at this site. These data could be used to expand the soil vapor extraction system, if necessary. A secondary objective was to begin removing contaminants from the soil in the area. Section 2.0 of this report outlines the site history, a summary of previous investigations, and the nature and extent of contamination. Section 3.0 presents the technical approach to the pilot system design, including the data collection program and the rationale for evaluating system performance. Section 4.0 presents the test results of the pilot program including an analysis of the data. Section 5.0 presents the conclusions gathered from the pilot program. Appendix A presents the well construction details including soil boring logs and geologic cross sections. Appendix B presents raw analytical results from the SVE sampling program.

2.0

SITE BACKGROUND AND INTERIM ACTION INVESTIGATION

This section presents background information on the Motor Pool Area, including site history and the nature and extent of contamination based on previous field investigations. The October 1990 soil investigation and the scope and objectives of the pilot test are also discussed.

2.1 SITE DESCRIPTION

2.1.1 Location

Rocky Mountain Arsenal (RMA) occupies more than 17,000 acres (approximately 27 square miles) in Adams County, directly northeast of metropolitan Denver, Colorado (Figure 2-1). The Motor Pool Area consists of the developed area in the southeastern corner of Section 4 on the RMA. The Motor Pool Area is located near the rail yard, on the west side of the boundary line between Sections 3 and 4, and is approximately 650 feet (east-west) by 2,300 feet (north-south). Structures within the site include 7 above-ground fuel and oil storage tanks, 26 buildings and foundations for 3 buildings that have been removed. The structures consist of administration buildings, motor vehicle storage and maintenance buildings, warehouses, railroad roundhouse and tracks, former agricultural research buildings, fuel storage tanks, fuel station, and a groundwater well pumphouse (Figure 2-2).

2.1.2 History

Prior to 1942, the Motor Pool Area consisted of farm land that was used to produce wheat and corn, or was used as grass land for hay and grazing of cattle. The Motor Pool Area was acquired by the U.S. Army in 1942 as part of RMA. Railroad spurs into the study area, entering across the northwest and southern boundaries, were built during the initial construction of RMA (Ebasco 1989a).

Most of the structures in the study area were built by the Army during the initial construction period of 1942 to 1943. During this period, a sanitary sewer system was constructed that extended north from the Motor Pool and rail yard areas. Portions of the sewer ended in septic tanks and leach fields. In 1945, construction of the sewer was completed with the installation of two pump stations and a pressure pipe that discharged eastward to an outfall into the interceptor line north of the Administration area.

Since the 1940s, the Motor Pool Area has been used by RMA for servicing equipment, vehicles, and railroad cars, as well as for storing fuel, road oil, and flammable liquids.

The roundhouse (Building 631) has been in use since the beginning of operations at RMA in 1942. It has been used for the maintenance of locomotives, railcars, and other heavy equipment. Solvents used to clean parts and surfaces may have been discharged either to a ditch east of the roundhouse or to a septic tank. From 1968 to 1982, the building was used by the U.S. Army reserve units for vehicle maintenance. From 1975 to 1985, it was occasionally used as a repair shop for earth-moving equipment. A small structure for storing cleaning solvents and paint thinners, which were used in Building 631, is attached to Building 631.

Previous Motor Pool Area investigative studies include: a May 1984 Resource Conservation and Recovery Act (RCRA) audit by the Colorado Department of Health (Ebasco 1989a) in the area outside the roundhouse; a 1986 study to identify possible trichloroethylene (TCE) sources in the Motor Pool Area (Ebasco 1988); and a soil gas study conducted in February 1986 to aid in defining the presence of trichloroethylene in the groundwater (Ebasco 1987). The most recent studies include the Contamination Assessment Report (Ebasco 1988); the Western Study Area Report (Ebasco 1989a); a soil gas survey conducted in summer 1989 (WCC 1989), and a pre-design data collection program in October 1990 (WCC 1991a).

2.1.3 Site Geology

The Motor Pool Area is in Section 4 near the western boundary of the RMA. The ground surface in the study area is essentially flat with a nominal slope toward the northwest. There are two stratigraphic units of interest beneath the Motor Pool Area:

the Quaternary Alluvium and the Denver Formation. The alluvial material consists of discontinuous lenses of sand and gravel, interbedded with silt and clay. Gravels and gravelly sands are common at the base of the alluvial section, especially in paleochannels. The alluvial material ranges from about 70 feet to about 100 feet in thickness. Groundwater has been observed at between 60 and 70 feet below ground surface. The thickest alluvium occurs over bedrock lows, and the thinnest over bedrock highs.

The alluvium-bedrock contact is highly irregular due to the extensive erosion that was caused by ancient stream channels, which preceded the deposition of the alluvium. Generally, the bedrock surface slopes to the northwest in the Motor Pool Area; however, where the bedrock surface has been incised by an ancient stream channel, the slope becomes perpendicular to the trend of the paleochannel. A northwest trending paleochannel cuts across the northern boundary of the Motor Pool Area and has approximately 70 feet of relief.

The Denver Formation in the Motor Pool Area is predominantly composed of claystone with interbedded sandstone, siltstone, and lignite layers that vary from about 2 feet to approximately 20 feet thick. Layers of volcaniclastics are also present in the bedrock (Ebasco 1989a).

2.2 NATURE AND EXTENT OF CONTAMINATION

A summary of the nature and extent of contaminants found in the Motor Pool Area is discussed in this section. Information used in this summary was obtained from previous studies, including a soil gas investigation conducted in February 1986 to aid in defining trichloroethylene plumes in the groundwater (Ebasco 1987), a Contamination Assessment Report (Ebasco 1988), the Western Study Area Report (Ebasco 1989a), a soil gas survey conducted in summer 1989 (WCC 1990), and a pre-design data collection program in October 1990 (WCC 1991a). These reports can be referenced for additional details.

2.2.1 Soil Contamination

The soils investigations of the Motor Pool Area have been in three general areas:

- Repair, salvage, and surplus facility (Building 624) and railroad roundhouse (Building 631) areas
- Motor Pool and vehicle maintenance facility (Building 627) area
- Fuel tank storage area

The analytical data were derived from soil samples taken at various depths in the vadose zone. Sampling depths in the boreholes were generally 0 to 1, 4 to 5, 9 to 10, 14 to 15, and 19 to 20 feet. Borings greater than 20 feet in depth were sampled at 10-foot intervals below the 20 foot depth. A summary of the analytical results is shown in Table 2-1.

Indicator levels and ranges were established to assess the significance of organic and metal analytical values. Organic compound indicator levels are set at the certified reporting limit (CRL) for each compound. Metal indicator ranges are set within naturally occurring levels in the alluvial soils at RMA. These indicator ranges are shown in Table 2-1. A more detailed discussion of the selection of the indicator ranges can be found in the Introduction to the Contamination Assessment Reports (ESE 1987).

Trichloroethylene was detected in the area between the roundhouse (Building 631) and Building 624, in a near-surface soil sample taken beneath a man-made drainage ditch. This suggests that, at some time in the past, chlorinated solvents used at these facilities were present in the north-trending ditch.

Concentrations of ICP metals (cadmium, chromium, copper, lead, and zinc) and arsenic above background levels were also found in near-surface soil samples taken from beneath the ditch. This is attributed to the sanding and paint stripping operations performed during equipment maintenance and repair (Final Contaminant Assessment Report, Ebasco, July 1988).

Methylene chloride, trichloropropene, and aldrin were present in soil samples taken near the roundhouse (Table 2-1).

At Building 627, tetrachloroethylene was detected between 18 and 30 feet below grade beneath the same north trending ditch that passes between Building 624 and the roundhouse. These detections may suggest infiltration from the upgradient discharges at the roundhouse and Building 624.

Dibromochloropropane, toluene, and benzothiazole were found in near-surface soil samples taken downgradient from a drainage pipe exiting the south side of Building 627. The drain pipe discharged hot water and detergent in the mid-1960s and diluted wastes from the wash bay since 1951 (Ebasco 1989a).

Methylnaphthalene, pyrene, and fluoranthene were detected in near-surface soil samples taken in the north trending ditch west of Buildings 624 and 627. These analytes are attributed to leaching from railroad ties that had been treated with wood preservatives (Ebasco 1989a).

The fuel tank storage area is located west of Building 627 and consists of seven above-ground tanks. Soil samples from the area showed the following analytes to be present in the near-surface soils (concentrations are summarized in Table 2-1):

- Methylcyclohexane
- Benzene
- Ethylbenzene
- m-Xylene
- Toluene
- Methylnaphthalene

Lead and zinc occurred in surface soils at concentrations slightly exceeding their indicator ranges.

2.2.2 Previous Soil Gas Surveys

Three soil gas investigations have been conducted in the Motor Pool Area to locate organic contaminants. The first soil gas program was conducted in early 1986 (Ebasco 1987) when groundwater sampling had initially detected trichloroethylene near the roundhouse and Building 624. The trichloroethylene soil gas data showed a trichloroethylene soil vapor plume extending northwest from the Motor Pool Area. Another 1986 soil gas program used static samplers over a 1-month period. This study confirmed previous study results (Ebasco 1987).

The most recent soil gas investigation of the Motor Pool Area was conducted in July 1989. Eighty soil gas samples and 6 soil samples were collected in the study area. Sampling depths were 5, 10, 15, and 20 feet below grade, with a standard sampling depth of 5 feet. Sampling results are shown in Figure 2-3.

The volatile organic compounds that were analyzed for at each of the sampling locations included:

- Trichloroethylene (TCE)
- Trans 1,2 Dichloroethylene
- Cis 1,2 Dichloroethylene
- 1,1 Dichloroethylene
- Benzene
- Toluene
- Ethyl benzene
- o, m, p-Xylene

Measured concentrations of TCE in soil gas ranged from the detection limit (0.01 μ g/l) to about 600 μ g/l, with concentrations of TCE typically greater than 200 μ g/l in the soil gas between Buildings 624 and 625. Figures 2-3 and 2-4 show the results of the grid sampling conducted in 1989. Additional samples taken in the immediate vicinity of building 624 are presented in tabular form in the field investigation report (WCC 1989).

Evidence seems to indicate that the origin of this TCE contamination is a 3-inch diameter floor drain, shown on 1942 plumbing plans of Building 624, that leads to an outside ditch located between Buildings 624 and 625. TCE was used as a degreasing agent in Building 624.

2.2.3 Groundwater Contamination

Groundwater in the Motor Pool area is 60 to 65 feet below the ground surface (Ebasco 1989a). During the soil gas survey conducted in 1986 at the Motor Pool Area, high TCE concentrations were detected near Buildings 624 and 631 (Ebasco 1987). Groundwater samples from the nearby alluvial wells detected TCE. From these data, the trichloroethylene alluvial groundwater plume is interpreted to originate in the Motor Pool Area and extend to the north-northwest (Figure 2-5). None of the Denver Formation wells in the western study area detected TCE. This finding suggests that the plume is confined in the upper portion of the unconfined aquifer at this site. Refer to the Remedial Investigation Final Report (Ebasco 1989a) for a detailed discussion on the groundwater contamination originating from the Motor Pool Area.

2.3 OCTOBER 1990 SOIL INVESTIGATION

Previous soil investigations at the Motor Pool Area have detected TCE in the soil (Table 2-1). Soil gas surveys in the area have found TCE in soil gas (Figure 2-3). Groundwater investigations have consistently detected elevated levels of TCE in groundwater in the Motor Pool Area (Ebasco 1989a). However, those investigations did not provide the information necessary to design a soil vapor extraction system. Therefore, a focused soil investigation was performed at the Motor Pool Area in October 1990.

The objective of this study was to further characterize the lateral and vertical extent of volatile halogenated organics (VHOs) in soil immediately to the west of Buildings 624 and 625, for purposes of collecting baseline information for the SVE system evaluation. A total of five borings were drilled and sampled at five-foot intervals between ground surface and groundwater. The samples were analyzed for VHOs. The boring locations (Figure 2-6) were selected to characterize the apparent plume observed during the 1989 soil gas survey (Figure 2-4).

Carbon-tetrachloride (CCl₄) was the only target analyte detected in the soil samples collected. The sample taken from boring COEMPA0005 from the 18 to 19 foot interval indicated CCl₄ at a concentration of 0.592 μ g/g. The duplicate sample collected from the 17 to 18 foot interval reported CCl₄ as less than (LT) the certified reporting limit indicating the possibility the detection of this compound was due to a lab contaminant. All other samples were reported as LT for all the VHO target analytes.

Two of the borings (COEMPA0001 and COEMPA0002) were completed as soil gas extraction wells (VES-1 and VES-2, respectively). Well construction details can be found in the Implementation Document. These wells were used to conduct an initial air permeability test to establish a relationship between soil gas flow rate and vacuum applied at the well heads. This information, along with the analytical data from the soil investigation, were used to design the pilot system.

2.4 SCOPE OF PILOT PROGRAM

The five-month pilot program described in Section 3.0 focused on applying Soil Vapor Extraction to a volume of soil which has been shown to contain elevated levels of TCE in the soil gas. The soil vapor extraction wells used for the pilot program (VES-3 and VES-4) are located near the northwest corner of Building 624, approximately corresponding to the highest concentrations of TCE in soil gas detected in the 1989 soil gas survey. The soil to be addressed during the pilot test extends from the surface to groundwater, approximately 63 feet below ground surface.

The pilot program collected engineering data to confirm estimates of flow rate for the extraction wells and the radius of influence from each well. Soil permeability data was obtained when extracting from both wells to confirm the preliminary results gathered in a previous one-day study. Results of soil gas analyses were used with these data to estimate the quantitative effectiveness of vapor extraction at varying depths at this site.

Sheet 1 of 3

TABLE 2-1

SUMMARY OF SOIL SAMPLE ANALYTICAL RESULTS MOTOR POOL AREA

Analytical Groups and Analytes Detected	Frequency of Detections ¹	Range (µg/g)	CRL Range $(\mu g/g)^{\prime 2}$	Indicator Range (μg/1)
Organochlorine Pesticides Aldrin	2/163	0.9-3	0.3	
Arsenic	16/152	2.6-27	2.5-5	CRL-10
Mercury	14/152	0.057-0.38	0.050-0.060	CRL-0.1
Cadmium Chromium Copper Lead Zinc DBCP Fluoranthene*	13/152 62/152 100/152 37/152 146/152 1/177 5/163	1.4-30 6.5-490 5.7-220 9.8-2000 11-2300 0.01	0.66-0.74 5.2-6.5 4.7-4.9 8.4-13 8.7-9.5 0.0050	1-2 25-40 20-35 25-40 60-80
ryrene Methyl naphthalene*	8/163	4-200	0.3*	

Sheet 2 of 3

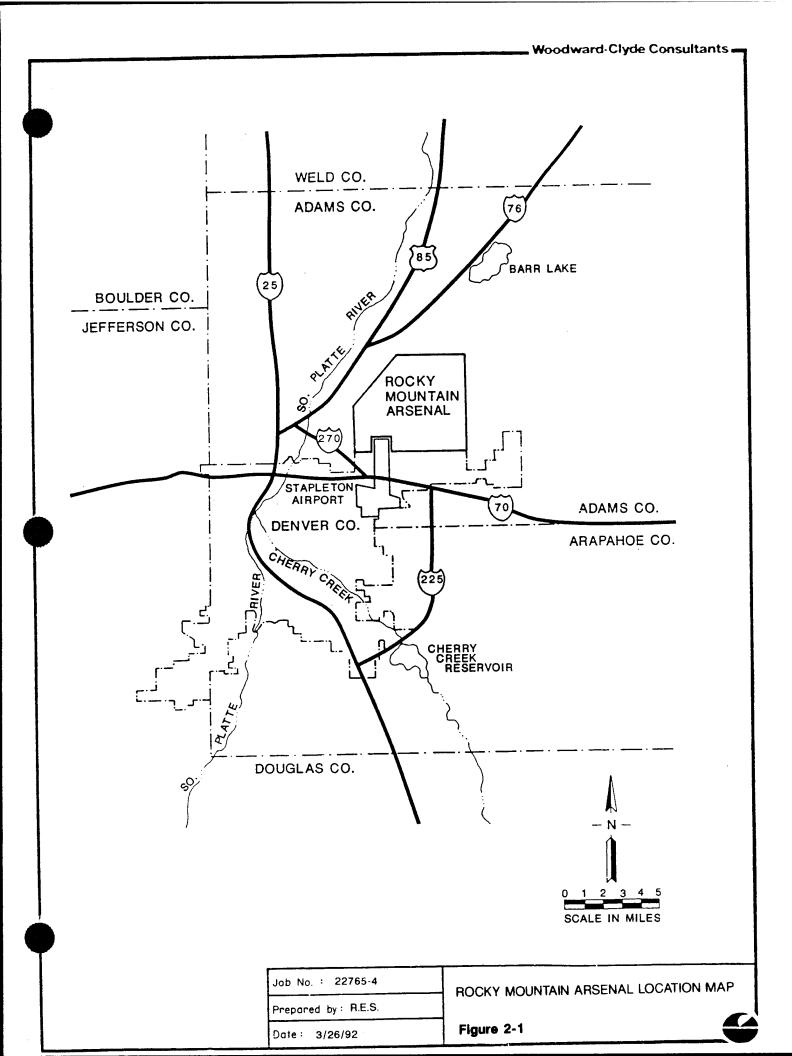
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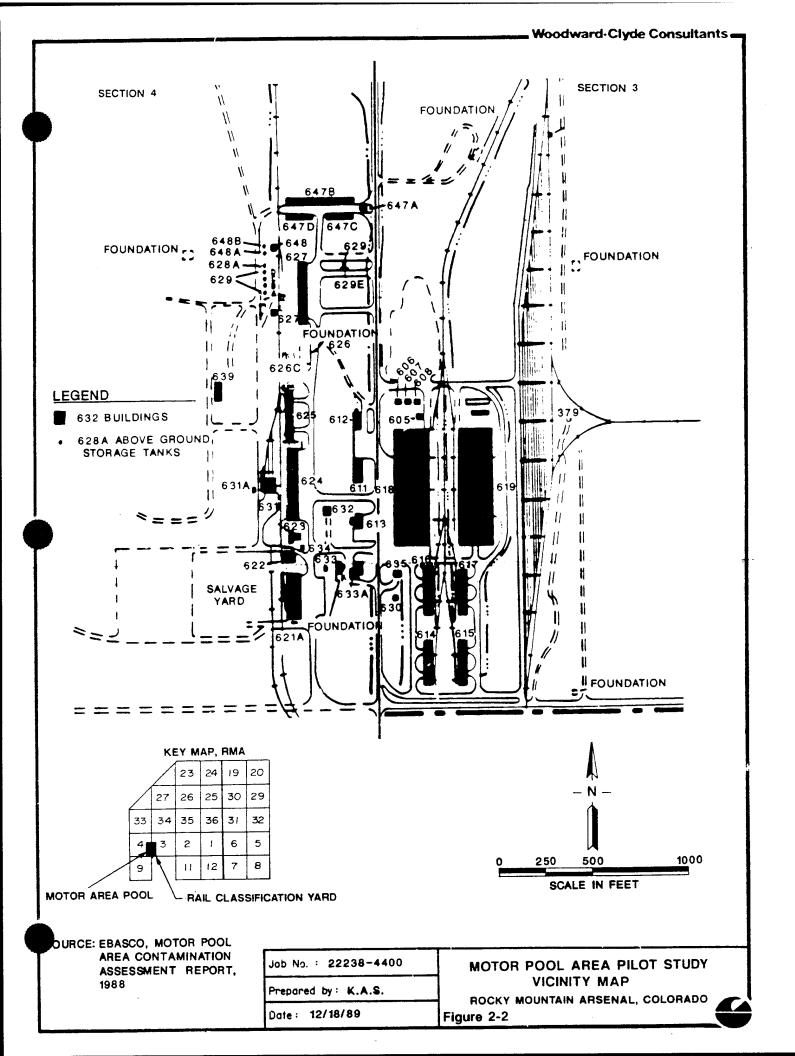
Analytical Groups and Analytes Detected	Frequency of Detections ¹	Range (ug/g)	CRL Range (ug/g) ^{/2}	Indicator Range (ug/1)
Volatile Halogenated Organics Tetrachloroethylene Trichloroethylene Trichloropropene*	3/135 1/135 1/135	0.4-1 2 0.2	0.3 0.3-0.5 0.3*	
Methylene Chloride	1/135	E	0.7-2	
Volatile Hydrocarbons 4-Hydroxy-4-methyl-2-pentanone* Methylcyclohexane*	1/135 2/135	4 2-10	0.3* 0.3*	
Volatile Aromatic Organics Ethylbenzene m-Xylene Toluene	1/135 1/135 2/135	4 2-4	0.3-0.4 0.7-0.8 0.3	
Organosulfur Compounds Benzothiozole	1/163	0.3	0.3*	

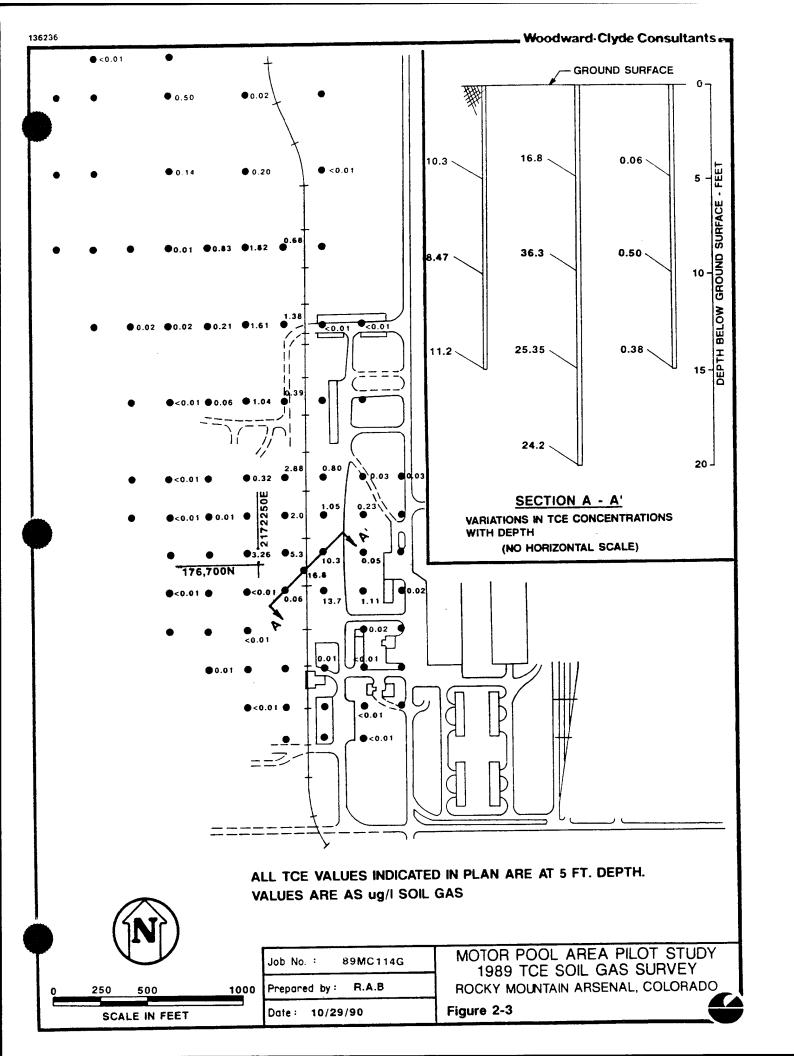
 $\mu g/g$ - Micrograms per gram

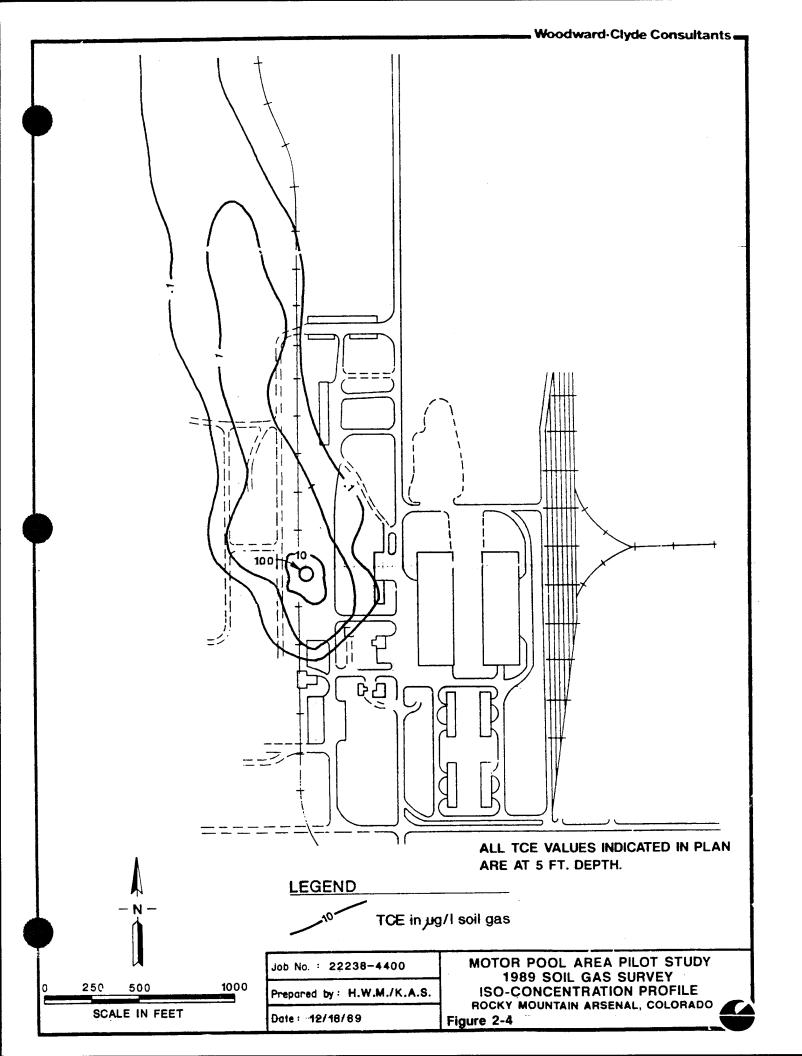
- conducted on all samples. This value does not include multiple detections of a specific analyte in the same sample, which occasionally has occurred when more than one analytical method has been used. Total number of borings, 36; Fraction represents the total number of samples with detections of an analyte in relation to the number of analyses total number of samples, 165.
 - Certified Reporting Limit (CRL) or detection limit which varies among laboratories conducting analyses.
- There is no CRL for tentatively identified compounds. The value shown is a detection unit based on 10% of the internal standard for the method used. The number of detections is given, but the number of samples is not.

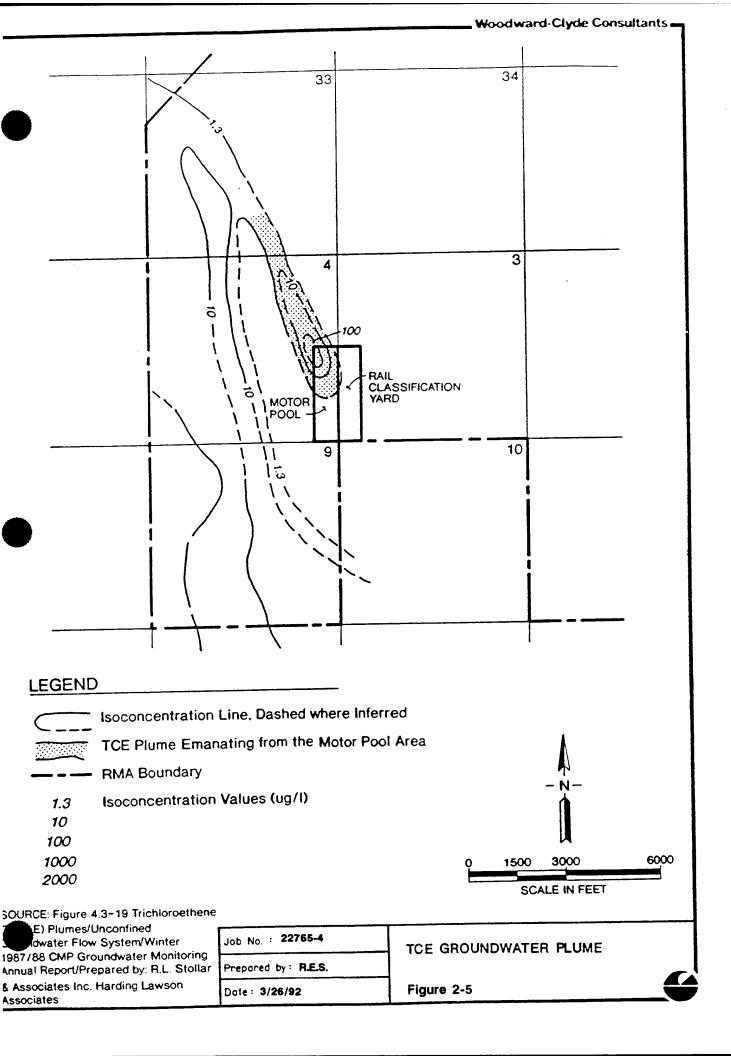
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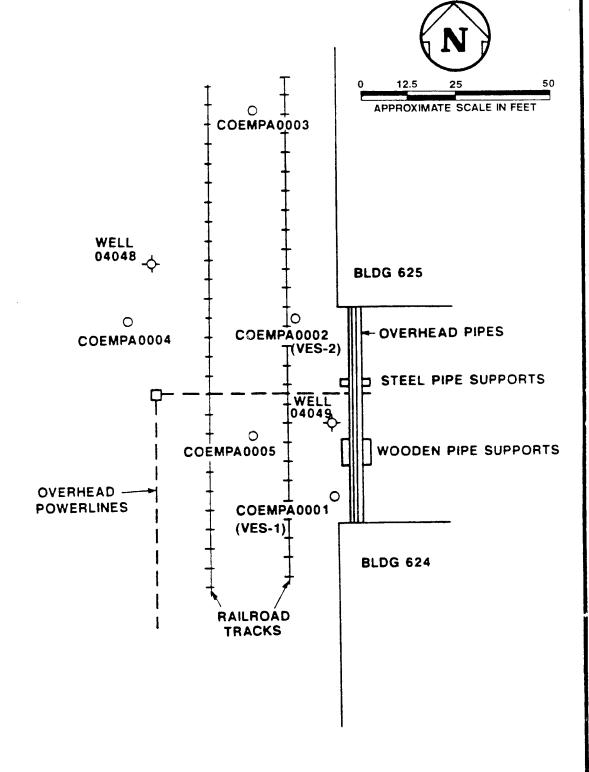












LEGEND

O BORING COEMPA00X

NOTE:

BORING COEMPA0001 AND BORING COEMPA0002 WERE COMPLETED AS SOIL VAPOR EXTRACTION WELLS (VES-1 AND VES-2, RESPECTIVELY)

> MOTOR POOL AREA PRE-DESIGN Job No. : 89MC114G STUDY BORING LOCATIONS Prepared by: R.A.B. ROCKY MOUNTAIN ARSENAL, COLORADO Date: 10/9/90

FIGURE 2-6



3.0 TECHNICAL APPROACH

This section presents a description of the SVE system used for this pilot study and discusses details of the pilot test operation as well as the data collection and analysis program.

3.1 SYSTEM DESCRIPTION

In situ soil vapor extraction systems provide a method to remove volatile organic compounds (VOCs) from contaminated soil. When operated properly, an SVE system can be one of the most cost-effective remediation processes for soils contaminated with gasoline, solvents, or other volatile compounds. When an SVE system is applicable, partial or complete remediation is possible using simple equipment, with minimal requirements for intrusive procedures such as excavation, and with little or no contaminated materials requiring disposal.

An SVE system, in its simplest form, consists of one or more extraction wells, a separation tank to remove entrained or condensed water, and a vacuum blower to draw vapors containing the volatile contaminants from the soil. Often, the extracted vapors may be discharged directly to the atmosphere. In some cases, because of regulatory requirements or health risks, above-ground treatment of the extracted vapors may be required. Treatment technologies commonly employed include adsorption of the vapor phase organic compounds on granular activated carbon (GAC) or thermal/catalytic treatment of the organic vapors.

3.1.1 Extraction and Monitoring Wells

As shown in Figure 3-1, two soil borings were completed as extraction wells (VES-1 and VES-2) during the 1990 soil sampling event. A one-day study was performed using these wells and a mobile SVE system to gather preliminary data to aid in the design of the pilot system. Based on the air permeability data obtained during this study, extraction wells VES-3 and VES-4 were installed for the pilot test. VES-3 was screened from

approximately 13 to 28 below ground surface (bgs) and was used for testing the shallow extraction zone. VES-4 was screened from approximately 43 to 58 feet bgs for testing a deeper screened interval. The purpose of extracting from both a deep and shallow zone was to assess the optimal screened interval for future vapor extraction wells in the event that the pilot test results indicated that additional vapor extraction wells were appropriate. The SVE system designed for this pilot study can be easily scaled up to accommodate additional extraction wells.

Based on the suspected plume gradient, four clusters of soil gas monitoring wells were installed at the locations shown in Figure 3-1. Each cluster had a well screened in the following locations: a shallow interval, (A), within the range of approximately 12 to 14 feet bgs, to evaluate whether any significant short-circuiting occurred as a result of air being drawn in from the ground surface; an intermediate interval, (B), within the clay layer to evaluate the effect of the SVE system on soil gas within the low permeability lens (30 to 38 feet bgs); and a deep interval, (C), within the range of approximately 52 to 56 feet bgs and near the groundwater table, to evaluate temporal trends of soil gas concentrations near the groundwater. Soil gas monitoring wells P-5, P-6, and P-7 extended radially to the north of the extraction wells, while P-8 was located to the west of the wells to evaluate radial variations.

The soil gas monitoring probes consisted of a 1-foot long, 1-inch-diameter slotted (.02-inch slots) PVC pipe with caps on both ends. During installation, the soil gas monitoring probes were lowered into the 4-inch diameter borings to the previously specified depth. A coarse sand was backfilled around the probes. Each probe was connected to the surface with ¼-inch diameter polyethylene tubing for monitoring the vacuum and TCE concentrations in the soil gas.

3.1.2 Above-Ground Equipment

The shallow and deep extraction wells were connected to the vacuum blower through an insulated PVC pipe installed on the ground surface. The blower and associated equipment were located in a temporary building near the northwest corner of Building 624. A liquid/vapor separator tank was installed between the extraction wells and the blower to allow for collection of any moisture that condensed from the gas stream. The

separation tank was equipped with an automatic vacuum relief valve, a vacuum gauge, a site gauge (to monitor the amount of water in the tank), a drain valve, and a liquid level float-operated switch to shut the system down, should the water level rise past a preset level. (No water was collected during the operation of this pilot unit.) An inline filter was installed prior to the blower to remove any fines or silts which could damage the blower impeller. A regenerative blower driven by a 10-hp electric motor, capable of moving 250 cubic feet per minute (cfm) at 30 inches of water (vacuum) was selected for this pilot system. This belt-driven blower had the capability of operating under a wide range of conditions. To remove TCE from the extracted gas, the exhaust air was discharged to a series of GAC canisters. The first series of vapor phase GAC canisters was capable of removing approximately 90 percent of the TCE from the extracted gas, while the second series of canisters served as polishing units. Refer to Figure 3-2, Process Flow Diagram, for locations of the monitoring instrumentation and sampling ports.

3.2 PILOT TEST OPERATION AND DATA COLLECTION PROGRAM

The Rocky Mountain Arsenal Motor Pool Area pilot test consisted of two sequential phases: short-term operation and long-term operation. Data was collected during these two phases of operation to provide information to meet the following objectives:

- Evaluate the horizontal and vertical soil gas VOC distribution at the Motor Pool Area to attempt to identify the nature or source of TCE.
- Evaluate the effectiveness of soil vapor extraction at the site.
- Evaluate the optimal extraction interval and operating conditions, based on observed pressure distributions, flow rates, and soil gas VOC distributions.

3.2.1 Short-Term Operation

The short-term operation period was conducted during the first four weeks of the pilot test where soil gas was extracted from VES-3 (shallow) for two weeks and then from

VES-4 (deep) for the two remaining weeks. Field sampling and analysis was performed on the first, third, and fifth days of both weeks, and laboratory analysis was performed on the first, third, and fifth days of the first week and in the middle of the second week. This program was repeated during weeks 3 and 4 when soil gas was extracted from the deep interval.

3.2.2 Long-Term Operation

The long-term operation began immediately following the short-term operation period and continued for approximately four additional months. Soil gas was extracted from the shallow interval during the first part of the long-term operation. Soil gas extraction continued at a steady state for approximately two weeks. System operation was then suspended for one week. This cycle was repeated three times while extracting soil gas from the shallow unit. Soil gas was then extracted from the deep interval, and the same cycle (steady state, recovery) was repeated three times.

3.2.3 Data Collection

The data collected from the short-term operation is summarized in Table 3-1, and the data collected from the long-term operation is summarized in Table 3-2. Field data collection included recording of barometric pressure; pressure readings at the extraction well (VES-3 or VES-4), separation tank, before the first GAC unit, between the two GAC units, after the second GAC unit, and at all three depths of each of the four soil gas monitoring wells; temperature readings before and after the GAC units; and flow rate of the extracted gas from the orifice meter. These data were used to evaluate operating parameters for remediation.

Field sampling and analysis was performed using TCE-specific Sensidyne tubes and/or a photoionization detector (HNu) at the following 15 points: gas extracted from either VES-3 or VES-4; gas between the two GAC units; gas after the second GAC unit; at all three depths for each of the four soil gas monitoring wells.

Confirmation sampling and analysis consisted of taking samples and sending the samples to a laboratory for chemical analysis. A modified NIOSH method using a Gilian®

personal sampling pump and charcoal tube samples was used for the confirmation sampling and analysis. Confirmation sampling and analysis was done at the following 14 points: gas extracted from either VES-3 or VES-4; gas after the second GAC unit; at all three depths of each of the four soil gas monitoring wells.

The long-term operation consisted of the six cycles as described above, with three cycles for shallow extraction and three cycles for deep extraction. Each cycle consisted of an initial sampling round followed by approximately two weeks of steady state operation and one week of suspended operation. Field data, field samples, and lab samples were collected at the beginning of each cycle. During steady state operations, field data were collected three times each week, field samples at the beginning and end of the week, and a lab sample was taken from the extraction well at the end of the week. At the end of the third cycle, the initial sampling set was performed at the end of the week of suspended operations, before the program was repeated in the deep interval.

Data were analyzed to evaluate the potential source(s) of the soil gas VOC concentrations, and to identify operating parameters for the SVE system during this program. Vacuum distribution was evaluated to determine flow patterns and chemical analysis was evaluated to estimate system performance. Analytical chemistry results can be found in Appendix B.

TABLE 3-1

SHORT-TERM OPERATION MONITORING PROGRAM MOTOR POOL SVE PILOT TEST

	Field Data Collection	Collection ¹	Field S	Field Sampling & Analysis ² (15 Sampling Points)	ılysis² s)	Lab (14	Laboratory Analysis ³ (14 Sampling Points)	is ³
Period of Operation	Frequency	No. of Sampling Events	Frequency	No. of Sampling Events	Total Number of Samples	Frequency	No. of Sampling Events	Total Number of Samples ⁴
Short-term Operation - Shallow Extraction (VES-3)								
First Week	Daily	5	First, third, and fifth day	m	45	First, third, and fifth day	к	51
Second Week	Daily	ς.	First, third, and fifth day	E	45	Once (mid-week)	-	17
Short-term Operation - Deep Extraction (VES-4)								
Third Week	Daily	\$	First, third, and fifth day	3	45	First, third, and fifth day	٤	51
Fourth Week	Daily	\$	First, third, and fifth day	æ	45	Once (mid-week)	1	17
Total				12	180		×	136

TABLE 3-1 (Concluded)

first GAC unit, between GAC units, after the second GAC unit, and at each of the three intervals (shallow, medium, and deep) of Field data collection includes recording of: pressure readings at the extraction well (VES-3 or VES-4), separation tank, before the each of the four monitoring wells; temperature readings before and after the GAC units; flow rate of extracted gas from the orifice meter; and field conditions (temperature, weather conditions, barometric pressure).

15 sampling points: the extraction well (VES-3 or VES-4); gas between the GAC units; gas after the second GAC unit; and gas from Field sampling and analysis involves the use of TCE-specific draeger tubes (or equivalent) and/or a photoionization detector at each of the three intervals (shallow, medium, and deep) of each of the four monitoring wells. Samples from 14 sampling points will be analyzed for VOC concentrations: the extraction well (VES-3 or VES-4); gas after the two GAC units; and gas from each of the three intervals (shallow, medium, and deep) of each of the four monitoring wells. Total number of samples includes a duplicate, field blank, and trip blank (QA/QC samples) for each sampling event (i.e., total number of samples = no. of sampling events x (14 sampling points + 3 QA/QC samples).

TABLE 3-2

LONG-TERM OPERATION MONITORING PROGRAM MOTOR POOL SVE PILOT TEST

	Field Data C	Data Collection ¹		Field (1.	Field Sampling & Analysis ² (15 Sampling Points)	lysis²	
Period of Cycle	Frequency	No. of Sampling Events	Frequency (per cycle)	No. of Sampling Events (per cycle)	Frequency (for 3 cycles)	Total Number of Sampling Events (for 3 cycles)	Total No. of Samples
Initial Sample	Once	1	Once	-	1	1	15
Steady State	Three times per week	9	At beginning and end of each week	4	3	12	180
Recovery	Three times per week	w	Once	-	E	3	45
Total for Three Cycles (shallow well)	v well)					16	240
Total for Long-term Operation (shallow and deep well)	(shallow and deep	wcll)				32	480

Sheet 2 of 2

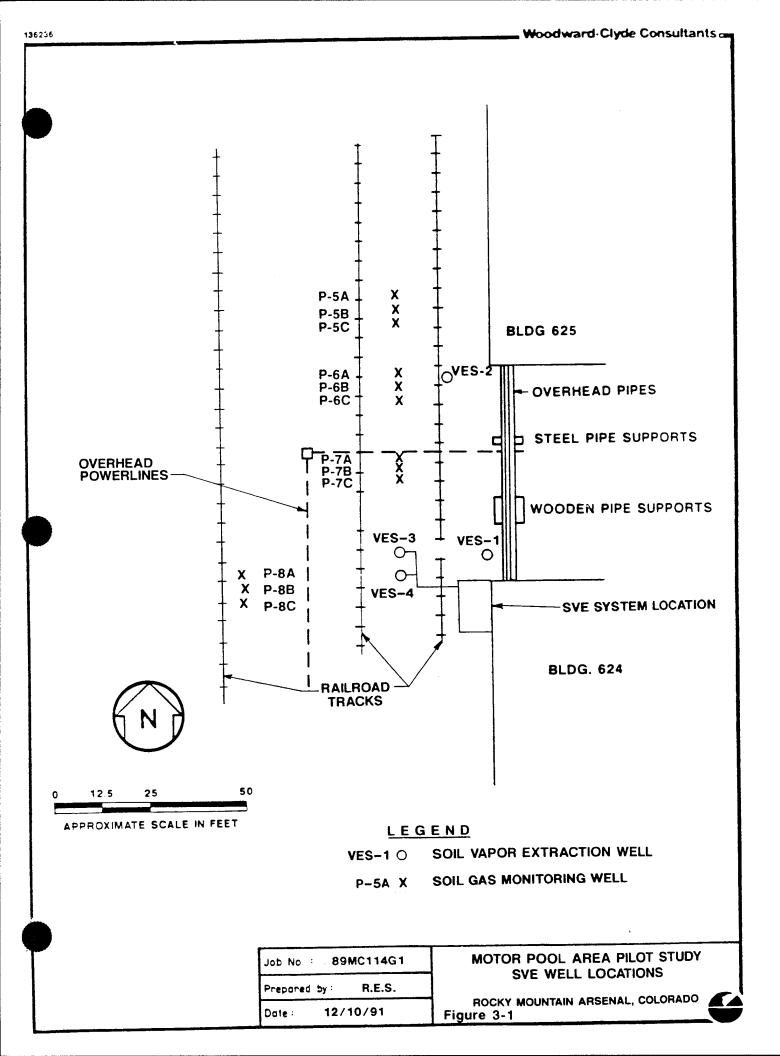
TABLE 3-2 (Concluded)

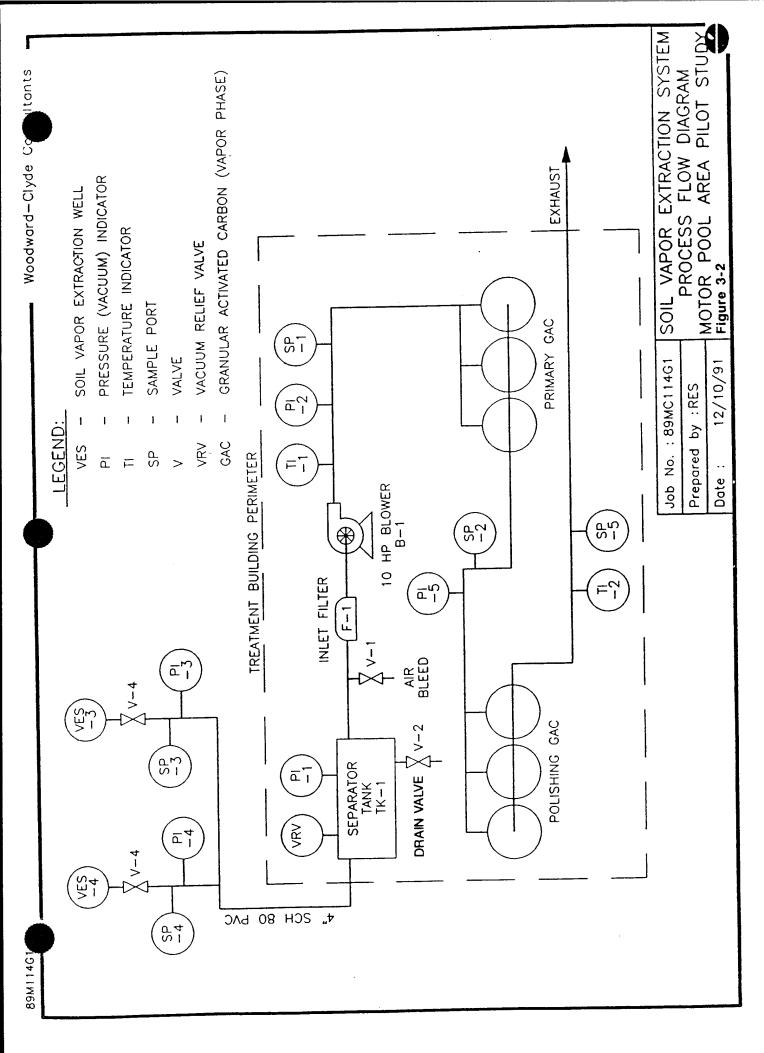
			Laborator	Laboratory Analysis ³		
Period of Cycle	Frequency (per cycle)	No. of Sampling Events (per cycle)	Frequency (for 3 cycles)	Total No. of Sampling Events (for 3 cycles)	No. of Sampling Total Number Points of Samples ⁴	Total Number of Samples ⁴
Initial Sample	Once	-	1	1	14	17
Steady State	At end of week	2	т	9	-	24
Recovery	Опсе	1	8	3	14	51
Total for Three Cycles (shallow well)	w well)			10		92
Total for Long-Term Operation (shallow and deep well)	on (shallow and deep we	(II)		20		184

Field data collection includes recording of: pressure readings at the extraction well (VES-3 or VES-4), separation tank, before the first GAC unit, between GAC units, after the second GAC unit, and at each of the three intervals of each of the four monitoring wells; temperature readings before and after the GAC units; flow rate of extracted gas from the orifice meter; and field conditions (temperature, weather conditions, barometric pressure). Field sampling and analysis involves the use of TCE-specific Draeger tubes (or equivalent) and/or photoionization detector at 15 sampling points: the extraction well (VES-3 or VES-4); gas between the GAC units; gas after the second GAC unit; and gas from each of the three intervals of each of the four monitoring wells.

Samples from 14 sampling points will be analyzed for VOC concentrations: the extraction well (VES-3 or VES-4); gas after the two GAC units; and gas from each of the three intervals of each of the four monitoring wells. When only one sampling point is specified, that point is the extraction well (VES-3 or VES-4).

Total number of samples includes a duplicate, field blank, and trip blank (OA/OC samples) for each sampling event (i.e., total number of samples = total no. of sampling events x (14 sampling points \pm 3 QA/QC samples))





4.0 OBSERVATIONS AND RESULTS

4.1 AIR PERMEABILITY TEST RESULTS

Prior to initiation of the data collection program, the soil permeability to air flow (a measure of the ability of air to pass through a porous media) was estimated to confirm the suitability of soil vapor extraction for this site. To calculate soil permeability, vacuum readings were taken at P-7B (representative of medium depth soil gas monitoring wells) at 5-minute intervals during system start-up. These readings were taken until steady state conditions were observed (approximately 30 minutes). Figure 4-1 shows a plot of vacuum at P-7B vs. the natural log of time when extracting from the shallow extraction well. This figure was used to predict the soil permeability to vapor flow in soils from the ground surface to approximately 38 feet bgs. The slope and Y-intercept of this plot were used in the following equation (Johnson et al., 1990) to predict soil permeability:

$$K = \frac{r^2 \epsilon \mu}{4 P_{atm}} \exp \left(\frac{B}{A} + 0.5772 \right)$$

where:

r = radial distance from vapor extraction well, 22 feet

 ϵ = air-filled soil void fraction, 0.3

 μ = viscosity of air, 1.8 x 10⁴ g/cm-s

 $K = \text{soil permeability to air flow (Darcys, or cm}^2)$

 P_{atm} = ambient atmospheric pressure, 0.83 atm

B = Y-intercept from plot of pressure vs. natural log of time

A = slope from plot of pressure vs. natural log of time

This equation predicts a soil permeability to air flow of 167 darcys, indicative of silty to clean sand (Freeze and Cherry, 1979). The soil permeability to air flow was also estimated for extraction of soil gas from the deep extraction well (VES-4). Vacuum readings were taken at P-5C (62.5 feet radially from the extraction well) at 5-minute

intervals until steady state conditions were observed. Using Figure 4-2 and the same correlation, soil permeability to air flow was estimated at 2860 darcys. The higher permeability in the deeper region is indicative of clean sand to gravel. The high soil permeability-to-vapor flow, in both the shallow and deep regions, confirmed the suitability of soil vapor extraction to remediate contaminated soils at the RMA MPA.

4.2 SHORT-TERM OPERATION

The short-term operation of the pilot study was completed August 9, 1991. Figure 4-3 shows the TCE concentration in the blower exhaust decreasing from 51.6 mg/l or parts per million (ppm) to 10.6 ppm after the first week of extraction from the shallow well, VES-3. Figure 4-4 shows the TCE concentration in the blower exhaust decreasing from 18.3 ppm to 5.8 ppm during a 10-day period of extraction from the deep well VES-4. Comparing Figures 4-3 and 4-4, it can be seen that the initial TCE concentration detected in the blower exhaust was greater during the shallow well extraction. It may have been that the majority of the remaining TCE in the vadose zone is present above the clay lens. This suggests that the contribution from TCE re-volatilizing from the groundwater is probably minimal.

4.3 LONG-TERM OPERATION

Figures 4-5 and 4-6 show the TCE concentration measured at the blower exhaust during the long-term operation for both the shallow and deep extraction wells. The exhaust concentrations ranged from 2,500 parts per billion (ppb) to 4,300 ppb in the shallow extraction well and 2,400 ppb to 2,800 ppb in the deep extraction well. This was considerably less than observed during the short-term operation, indicating that the majority of TCE contamination had been removed during the initial operation of the pilot study. As expected, the TCE concentration continued to decrease until the system was shut down for the designated recovery period. The TCE exhaust concentration increased slightly when system operation was initiated after the recovery period. For example, in the shallow well, the TCE concentration increased from approximately 2,500 ppb to 3,800 ppb during an initial recovery period. The results of the intermittent flow or pulsing operations suggest that the volatilization of TCE was somewhat limited

by either diffusion of the adsorbed TCE on the soil or the dissolved TCE in the groundwater to the induced air stream.

Table 4-1 presents the overall results of the pilot study for both short and long-term operation including TCE concentrations in the soil gas monitoring wells. The concentration of TCE measured at the blower exhaust during the entire pilot study is shown graphically in Figure 4-7. As seen in this figure, the exhaust concentration decreased rapidly during the short-term operation but remained low and relatively consistent throughout the remainder of the study.

4.4 SYSTEM EFFECTIVENESS

Figures 4-8 and 4-9 represent the vacuum measured at the monitoring wells as a function of their distance from the extraction well. The nearest monitoring wells are P-7 A, B, and C, at a distance of approximately 22 feet. The farthest wells are P-5 A, B, and C, at 62.5 feet. Figure 4-8 represents vacuum decreases with respect to distance, as measured in the shallow soil gas monitoring wells when extracting from the shallow interval. As expected, the vacuum in the shallow soil gas monitoring wells decreased as the distance from the shallow extraction well increased. Appreciable vacuum (0.6 inches of water column) was still being measured 62.5 feet from the extraction well at monitoring well P-5A indicating the lack of a surface seal did not significantly reduce the radial influence of the shallow extraction well. The vacuum at the medium and deep soil gas monitoring wells, although considerably less than in the shallow zone, remained relatively constant, independent of distance from the extraction well. It appears the clay lens prevented the shallow extraction well from effectively influencing the deeper regions.

Figure 4-9 shows the vacuum distribution during deep well extraction. The small and relatively constant vacuum measured in the shallow soil gas monitoring wells (12 to 14 feet bgs) indicates that the clay is apparently providing an effective boundary to soil gas flow. As predicted, the vacuum decreased with distance from the deep extraction well in the medium and deep soil gas monitoring wells.

The concentration of TCE in each of the soil gas monitoring wells had decreased to non-detectable or low levels during the course of the pilot study. Figures 4-10 through 4-13 depict the rapid decrease in soil gas concentrations in the shallow monitoring wells after completion of the short-term operation. In the shallow monitoring wells, intermittent flow operation did not result in an expected rebound in soil gas concentrations in the later recovery periods, indicating that the shallow region had been completely remediated with extraction from the shallow well. Figures 4-14 through 4-17 and Figures 4-18 through 4-21 show TCE concentrations over time in medium and deep regions of the monitoring wells, respectively. As with the shallow region, the TCE concentrations in the medium and deep regions decreased dramatically during the short-term operation. As shown in these figures, the initial recovery phases during the long-term operation did result in corresponding small increases in TCE concentrations as measured in the soil gas monitoring wells. The later recovery phases produced no significant increase in TCE concentrations.

Table 4-2 presents a summary of the typical operating conditions recorded during the SVE pilot study.

Figure 4-22 shows a plot of the total mass TCE extracted over the pilot study, with approximately 67 lbs removed in approximately five months of system operation. Although 1,2-dichloroethene and vinyl chloride were analyzed for during the test, neither analyte was observed in any of the samples.

TABLE 4-1

SVE PILOT STUDY SUMMARY OF ANALYTICAL RESULTS

						1	CE Concent	TCE Concentrations (ppm)	<u>-</u>					
Sampling Date	P-5A	P-5B	P-5C	P-6A	P-6B	P-6C	P-7A	P-7B	P-7C	P-8A	P-8B	P-8C	VES-3	VES-4
STS														
7-16-91	12.9	30.2	34.2	27.8	36.8	34.1	65.4	44.4	36.3	15.5	19.4	4.3		
7-17-91	23.5	6.3	ND	12.2	6.5	ND	7.6	10.8	QN	2.1	2.2	6:0	51.6	
7-19-91	5.3	20.0	23.4	6.5	20.1	26.5	ND	24.6	25.7	QN QN	11.6	11.9	16.7	
7-24-91	1.0	3.1	7.5	3.1	7.3	20.2	SZ	4.41	8.3	ON	4.2	ND	10.6	
STD														
7-29-91	QN	2.1	NO	1.1	3.1	2.1	ON	3.1	2.1	QN	3.2	ΩN		18.3
7-31-91	Q	0.7	2.8	ON	1.4	ND	ND	ND QN	2.2	ND Q	2.1	2.2		13.6
8-2-91	QN	QX	7.0	QN	1.4	1.4	NO	ND	1.4	QN QN	2.1	N		9.5
8-7-91	QZ	N	0.7	QN	1.4	1.5	QN	ZZ	1.4	ΩN	2.9	7.8		5.8
LTS														
8-12-91	ND	N	2.8	QN	ND	QN.	S	S	CN	S	ΩZ	2.1	3.6	
8-19-91	ND	0.7	QN	QN	0.7	2.8	SZ	2.1	2.1	ND	0.7	2.1	3.5	
8-26-91	QN ON	1.1	0.4	QN CIN	0.7	QN	CZ	0.7	CIN.	N	0.7	Q	2.7	
8-30-91	QN.	1.1	Q	ND QN	0.7	0.4	S	Ξ	Ξ	QN	0.4	0.7	f	
9-3-91	<u>O</u> N	0.4	0.7	QN QN	QN	0.4	S	ND	3.9	CN	0.4	QN ON	4.3	
9-9-91	Ö	QN QN	0.4	Q.	S	0.4	Ö.	S	S	ON	QN	1.0	2.8	
9-16-91	NO.	QN	QZ	<u>Q</u>	Q	ΩZ	QZ.	Ŝ	QX	ND	ΩN	QN QN	2.5	
9-20-91	Q Q	ND	Ŝ	QN CN	ON	0.7	Š	Q.	1.1	Ŝ	0.4	QN	1	

(Concluded) TABLE 4-1

Date P-5A	P-5B	P-5C	P-6.A	P-6B	P-6C	P-7.	P-7B	P-7C	P-8A	P-8B	P-8C	VES-3	VES-4
	0.7	0.7	QN	QN	2.0	NO	QN	QN	N Q	0.3	1.0	3.6	
10-1-91	0.5	1.2	QN.	0.7	1.4	S	1.1	1.6	QN	0.5	QN	2.8	
I0-7-9I	0.7	0.4	Q Q	6.0	2.1	CIN.	0.7	2.3	N O	0.5	1.6	3.2	
LTD													
I0-11-91	0.5	1.6	Q	7.0	1.2	QN ON	0.4	2.0	NO	ΩZ	1.9		1
10-15-91 ND	0.3	0.7	QN	0.4	NO	N ON	ON	ND	NO	0.4	2.1		2.6
10-21-91 ND	ON	0.5	ND	Z	ND	QN	S S	N C	QN QN	QN	ON.		2.8
10-28-91 ND	N	ND	N	QN QN	ΩŽ	S	ND	NO	ΩŽ	0.4	NO		2.4
11-1-91 ND	Q	CN	S	Î	N ON	CZ.	QN .	ΩŽ	QZ	ON	Ö		2.7
11-4-91 ND	NO	ND	ND	S	<u>C</u> Z	QN	Q.	QN	Q Z	ND	ND		2.7
11-11-91 ND	N Q	QN	S	S	QN	ND	QN QN	Q	CZ	QN QN	NΩ		1
11-18-91 ND	S	Q.	QN	Q	QN	ND	ND	QN	ND	ND	ΩN		2.4
12-2-91 ND	Q	ΩN	ND	ON	QN	NO	ND	1.1	ON O	0.2	1.4		2.7
12-9-91 ND	QZ	S	S	NO	N Q	ND	NO	9.0	QN	0.4	0.4		1.7
12-16-91 ND	QN	CN	QN	GN	QN	GN	ND	0.2	QN	ΩŽ	0.4		2.8

Sample not taken (recovery phase)
Non Detect
Short-term, shallow well (VES-4) extraction
Short-term, deep well (VES-4) extraction
Long-term, shallow well (VES-4) extraction
Long-term, deep well (VES-4) extraction ND STS STD LTS LTS

TABLE 4-2

SVE PILOT STUDY
SUMMARY OF TYPICAL OPERATING CONDITIONS

Well	Vacuum (in. H ₂ O)
VES-3	0 - 13.8
VES-4	0 - 30
P-5A	0 - 0.74
P-5B	0 - 0.50
P-5C	0 - 0.50
P-6A	0.10 - 1.2
P-6B	0.4 - 1.55
P-6C	0 - 2.05
P-7A	0.32 - 1.80
P-7B	0.30 - 3.0
P-7C	0.30 - 3.05
P-8A	0 - 1.85
P-8B	0 - 2.10
P-8C	0 - 2.30

Separator Tank Vacuum (PI-1): 18.2 - 36.5 in H₂O

Separator Level Gauge: 0 inches

Blower Exhaust Temperature (TI-1): 123 - 153°F
Blower Exhaust Pressure (PI-2): 8 - 12 in H₂O

Blower Exhaust (SP-1):

HNU: 0 - 20 ppm
 Sensidyne: 0 - 15 ppm

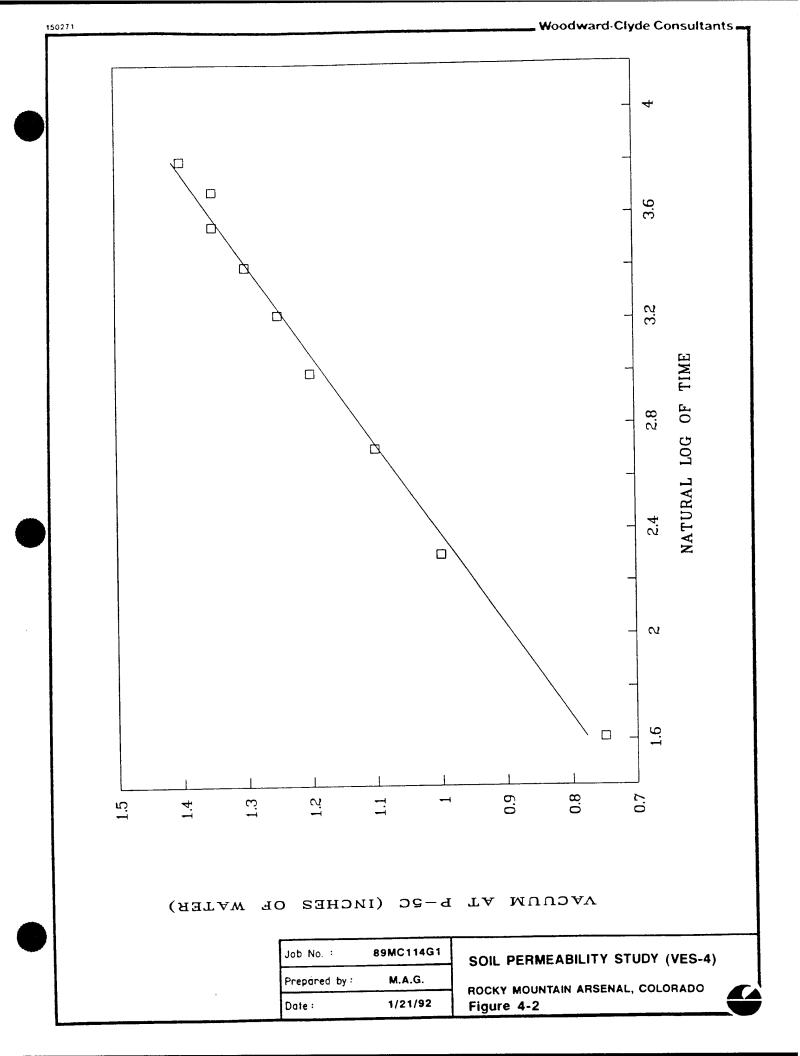
• Velocity: 2,600 - 6,000 ft/min.

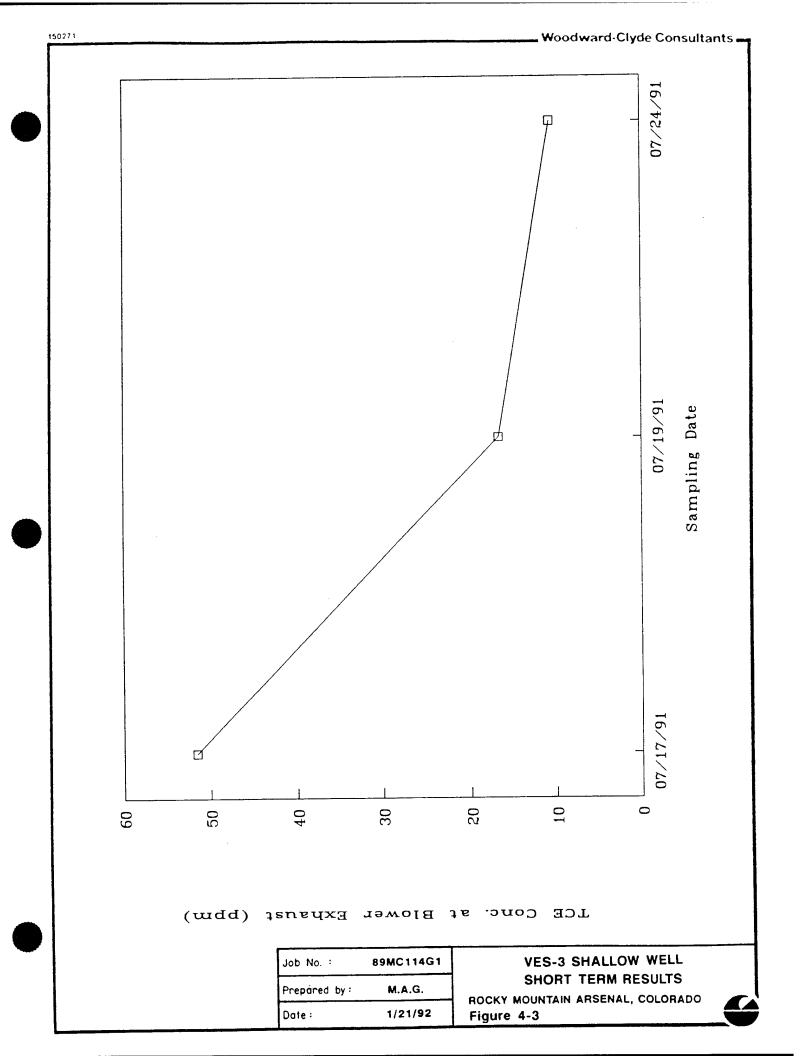
• Flow Rate: 145 - 335 cfm

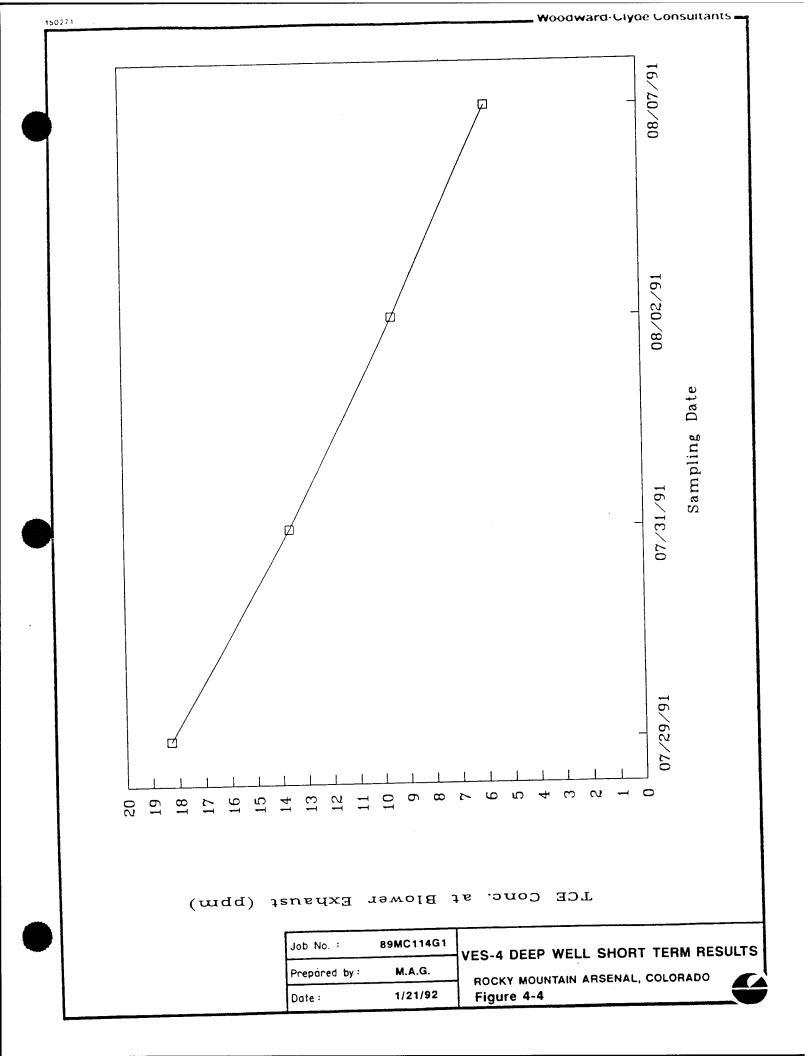
GAC Exhaust Temp (TI-2): 85 - 138°F

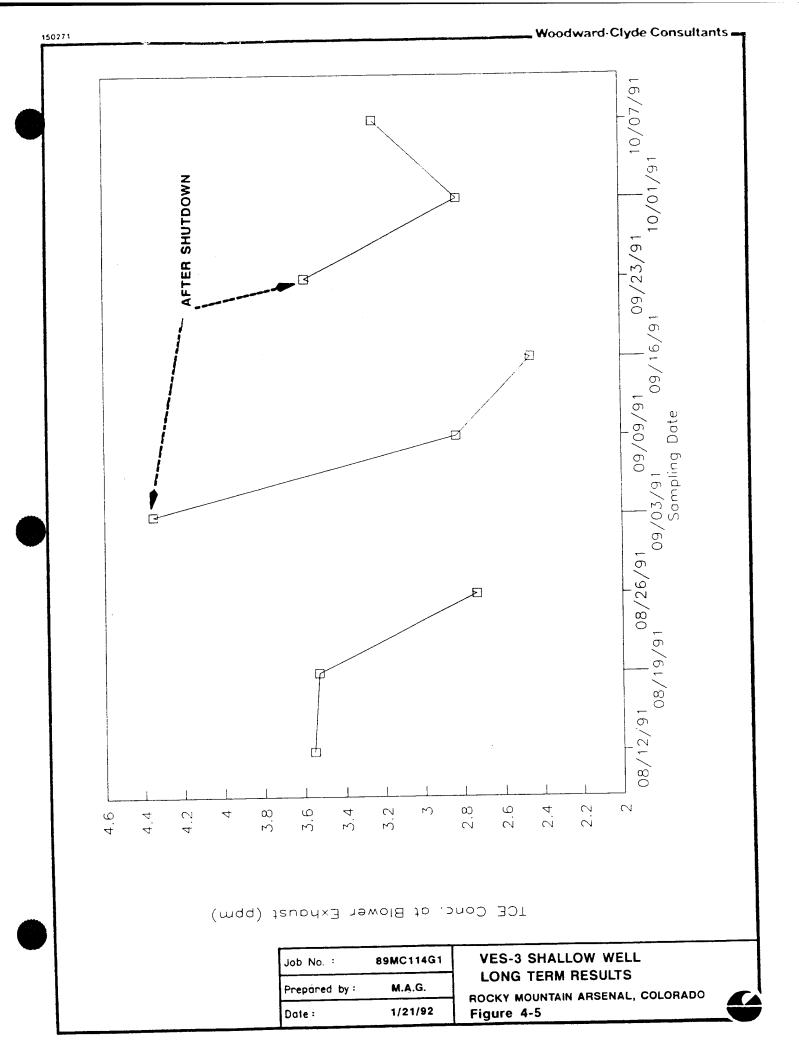
GAC Exhaust Concentration (SP-5) (13.7 lbs/day state emission limit):

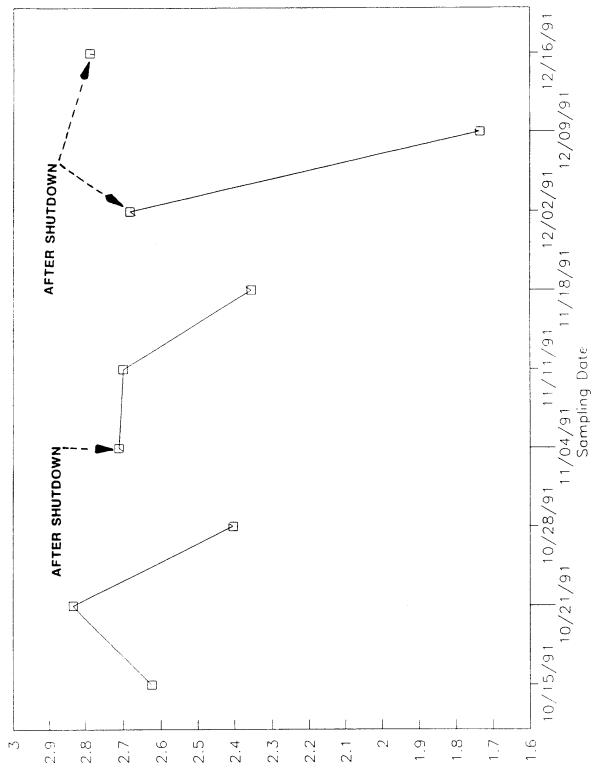
HNU: 0 - 3.7 ppm
 Sensidyne: 0 ppm









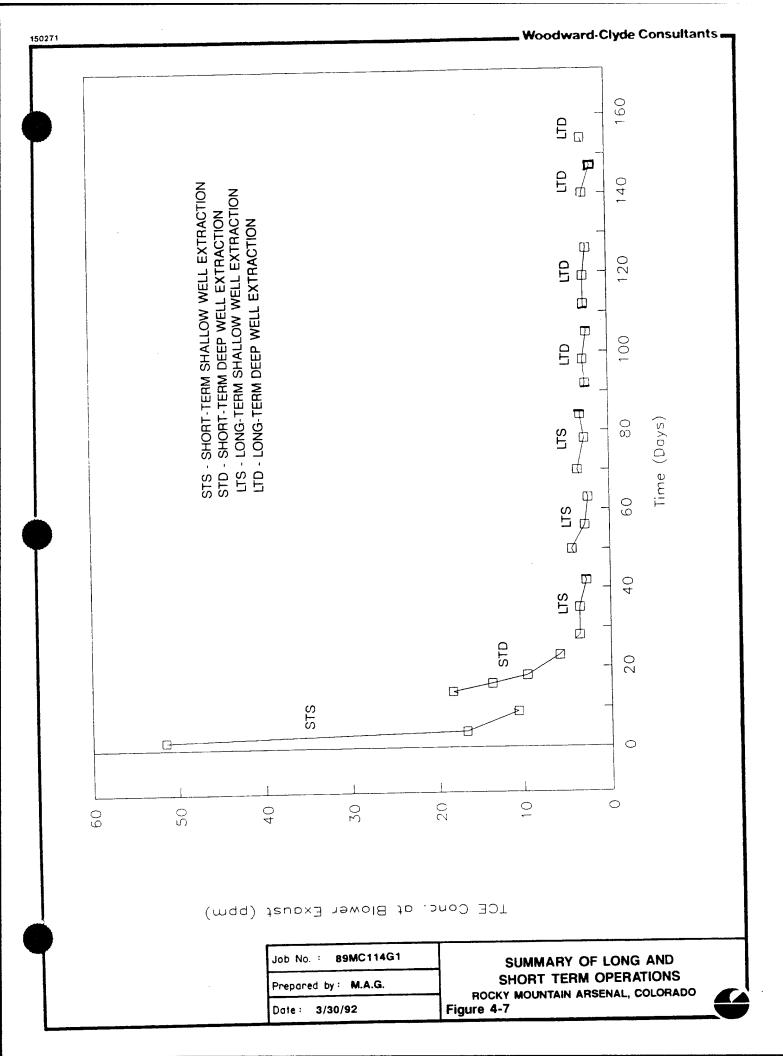


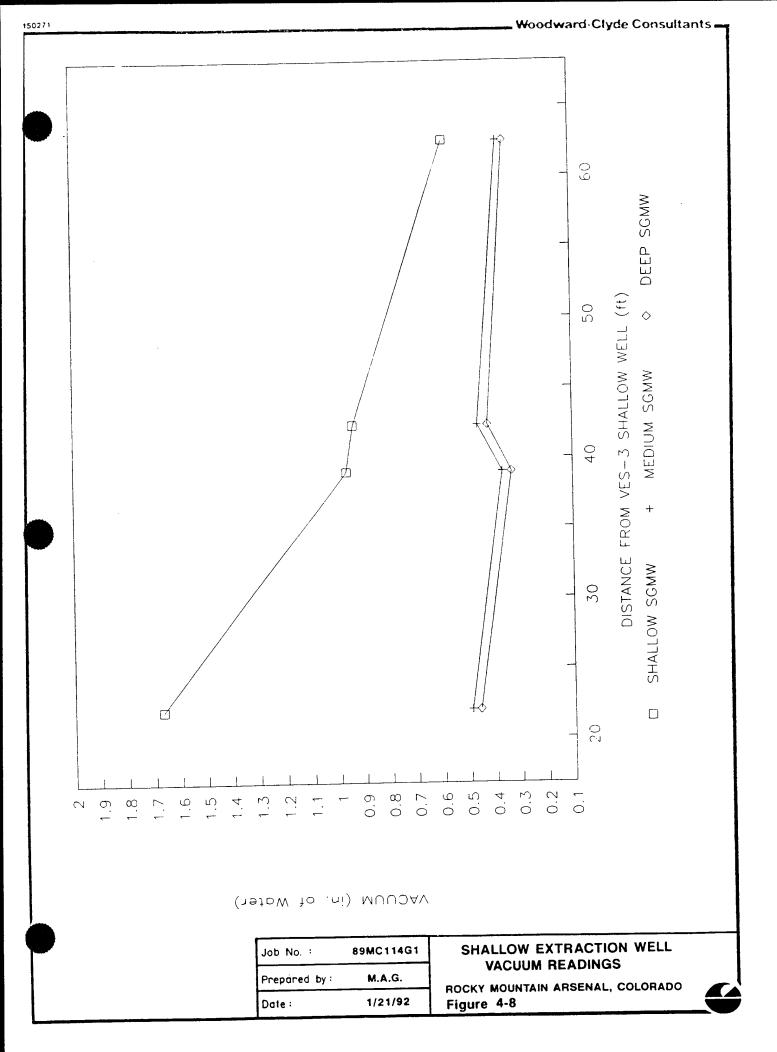
TCE Conc. at Blower Exaust (ppm)

89MC114G1 Job No. : Prepared by: M.A.G. 1/21/92

Date:

VES-4 DEEP WELL LONG TERM RESULTS

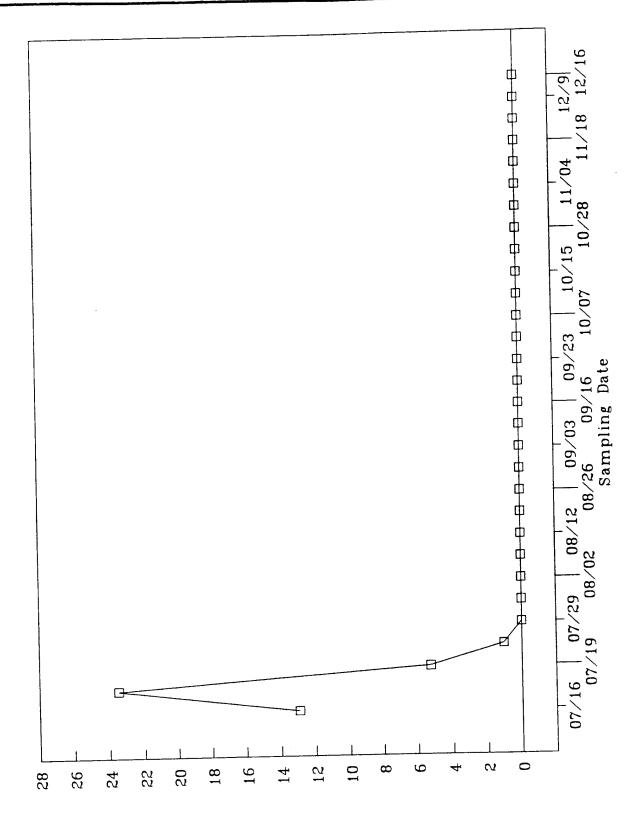




Job No. :	89MC114G1
Prepáred by:	M.A.G.
Date :	1/21/92

DEEP EXTRACTION WELL
VACUUM READINGS
ROCKY MOUNTAIN ARSENAL, COLORADO
Figure 4-9



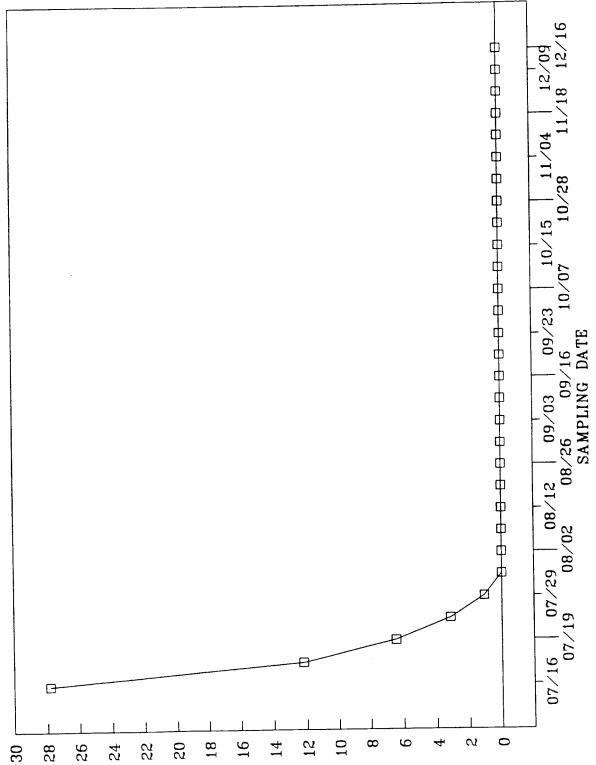


TCE Conc. at Monitoring Well (ppm)

Job No. :	89MC114G1
Prepared by:	M.A.G.
Date :	1/21/92

P-5A SHALLOW MONITORING WELL





Conc. At Montoring Well LCE (mdd)

Job No. :	89MC114G1
Prepared by:	M.A.G.
Date :	1/21/92

P-6A SHALLOW MONITORING WELL



Job No. :	89MC114G1
Prepared by:	M.A.G.
Date :	1/21/92

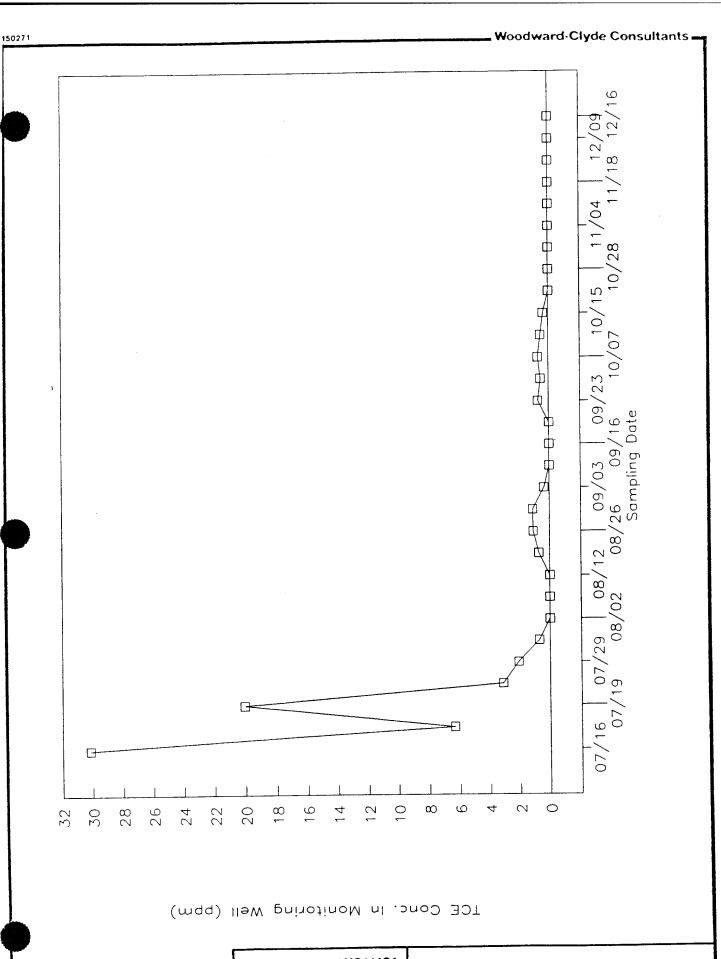
P-7A SHALLOW MONITORING WELL



1/21/92

Figure 4-13

Date:



 Job No. :
 89MC114G1

 Prepared by :
 M.A.G.

 Date :
 1/21/92

P-5B MEDIUM MONITORING WELL



Job No. :	89MC114G1
Prepáred by:	M.A.G.
Date :	1/21/92

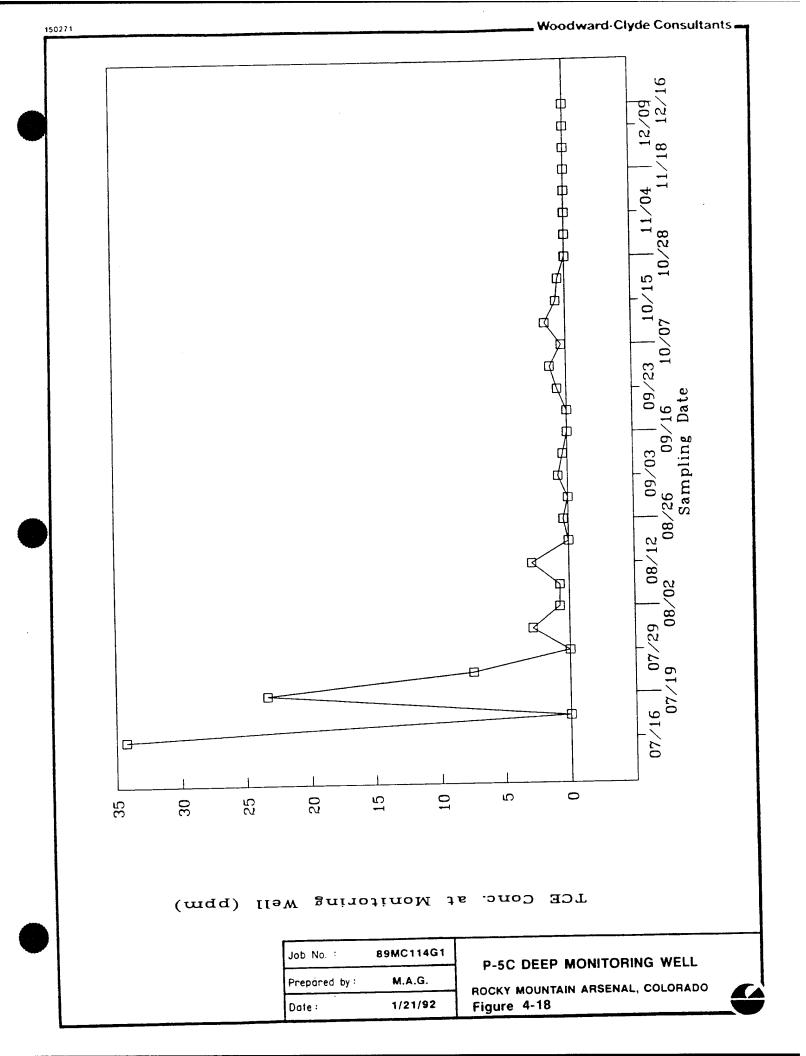
P-6B MEDIUM MONITORING WELL

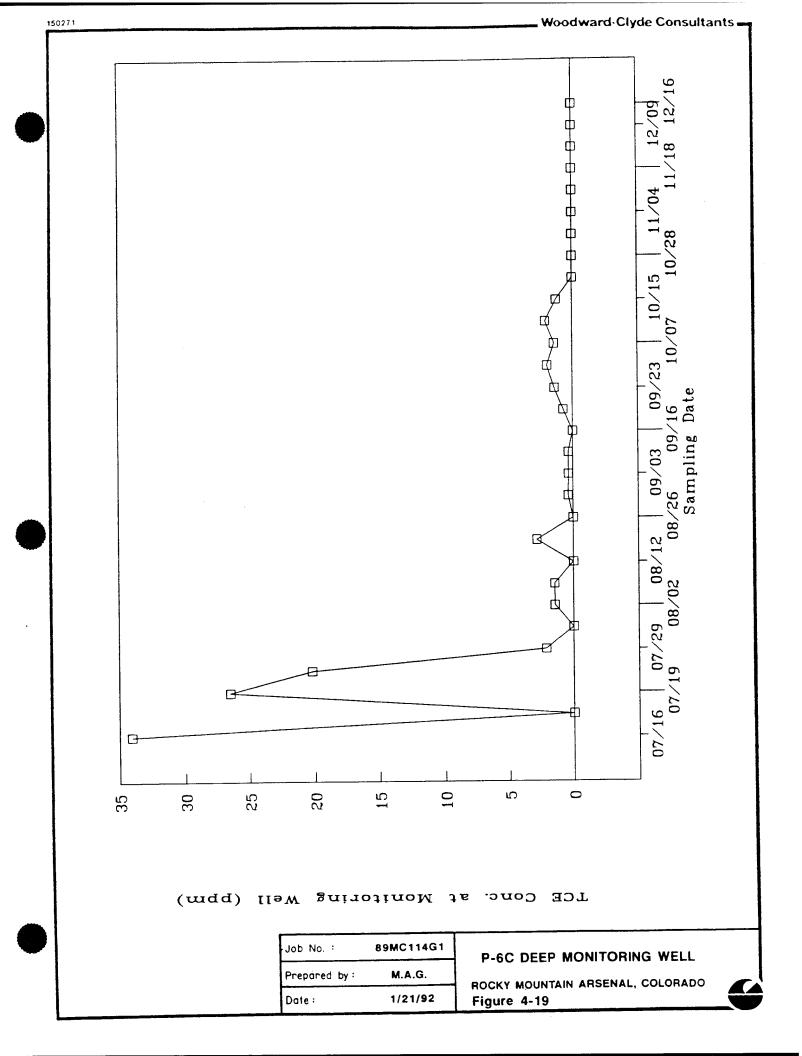


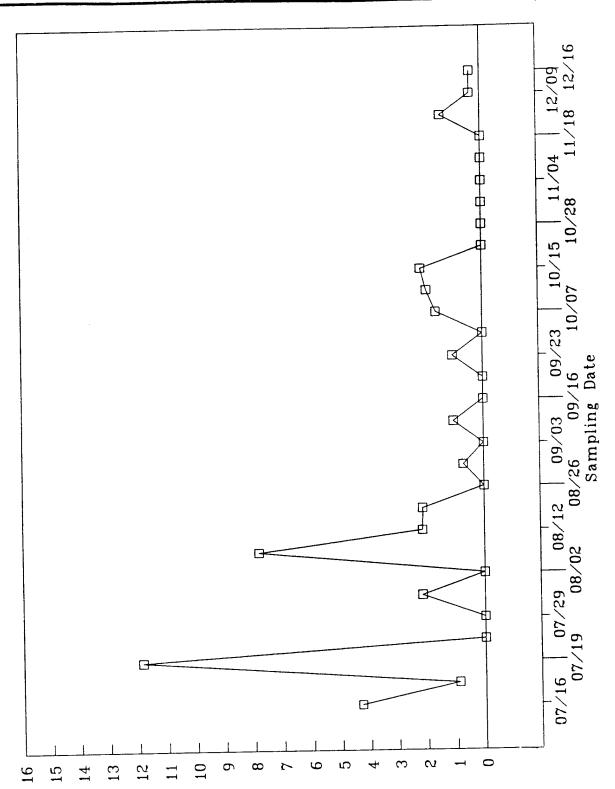
Job No. :	89MC114G1
Prepáred by:	M.A.G.
Date :	1/21/92

P-8B MEDIUM MONITORING WELL







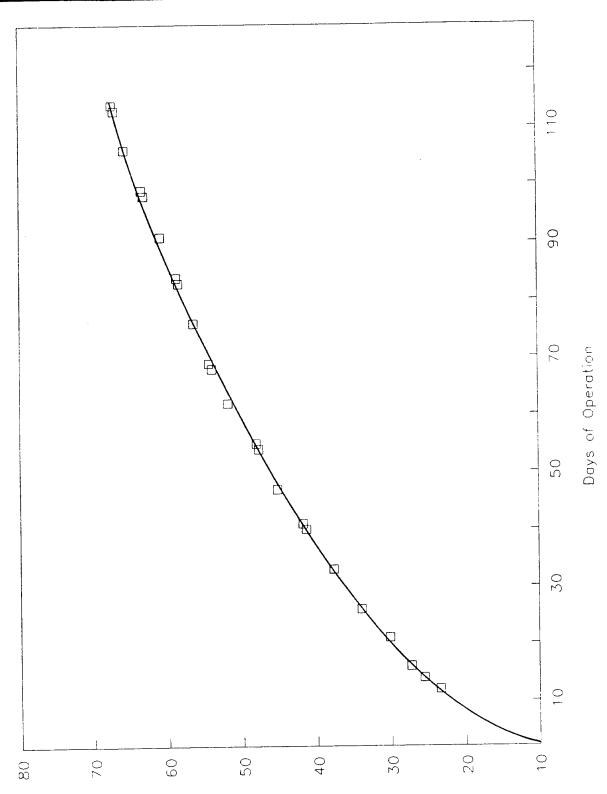


TCE Conc. In Monitoring Well (ppm)

Job No. :	89MC114G1
Prepared by:	M.A.G.
Date :	1/21/92

P-8C DEEP MONITORING WELL





Contaminated Products Extracted (Ibs.)

Job No. :	89MC114G1
Prepáred by:	M.A.G.
Date :	1/21/92

TOTAL MASS TCE EXTRACTED



5.0 CONCLUSIONS

Based on the pilot study testing conducted at the Rocky Mountain Arsenal Motor Pool Area, the following can be concluded:

- SVE was an effective remediation technique for removing TCE from the permeable soils found at this site.
- The majority of the TCE contamination was extracted from the shallow and medium regions, which suggests that the clay lens served as a partial vapor barrier to downward migration of TCE. Lower concentrations extracted from the deeper region suggest that re-volatilization of TCE from the groundwater was not a major contribution to the overall mass of TCE removed. It can be concluded the optimum extraction interval was the shallow well.
- Initial observed concentrations of TCE in the soil gas monitoring wells did not exhibit appreciable spacial variations. No conclusions were drawn with respect to horizontal distribution of TCE and potential source areas.
- Based on the vacuum induced in the remote soil gas monitoring probes when extracting from the shallow well, short-circuiting of atmospheric air was not significant, thereby precluding the need for a surface seal.
- TCE concentrations in the soil gas monitoring wells and blower exhaust decreased to non-detectable or low levels over the duration of this pilot study. It can be concluded that soil within the radial influence of the extraction wells (suspected source area) was remediated of TCE and no further extraction is required.

6.0 REFERENCES

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- Ebasco Services, Inc. May 1989a. Final Remedial Investigation Final Report, Vol. XII, Western Study Area, Version 3.3. RIC 89166R03.
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- Johnson, P.C., et al., A Practical Approach to the Design, Operation, and Monitoring of In Situ Soil-Venting Systems, <u>Ground Water Monitoring Review</u>, Vol. 10, No. 2, pp. 159-177, Spring 1990.
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APPENDIX A WELL CONSTRUCTION DETAILS

GROUNDWATER MONITORING WELL AND PIEZOMETER REPORT

PROJECT RMACOE MOTOR POOL VES 89M114G1 LOCATION Section 4 (9948 WCFS) Date Completed 6/6/9/ Original Depth 30' Inspected By H. MERRELL Date Checked By Date	Page of
Ground Elevation of top of surface casing. Height of top of surface seal below surface Type of surface casing. Type of surface casing. Type of surface casing. Type of surface casing. Type of backfill: GROUT Elev./depth top of seal. Type of sand pack. Elev./depth bottom of seal. Type of screened section. Elev./depth bottom of screened section.	ground 2' ground 2' ground 4" 4ed 40 10/2" 30' 5/2 E CHIPS // Ition, PVC FACTORY I section. 1umn 1ipn

GROUNDWATER MONITORING WELL AND PIEZOMETER REPORT

PROJECT RMACOE MOTOR POOL VES 89M 14G LOCATION Section 4 (9948 WCFS) Well No. VES - 4 Date Completed 6/7/9/ Original Depth 60' Aquifer NA Inspected By H. MERRELL Date Checked By Date Depth Interval 58-43					
Elevation of top of surface riser pipe. Height of top of surface seal below a surface Depth of surface seal: CONCE L.D. of surface casing. Type of surface casing below Q.D. of riser pipe. Type of fiser pipe: Type of backfill: GROUT Elev./depth top of seal. Type of sand pack. Depth of top of seal. Type of sand pack. Elev./depth top of seal. Type of screened section: Schotted Depth of bottom of sond co Type of backfill below observa pipe Elev./depth bottom of sond co Type of backfill below observa pipe Elev./depth of hole.	ground 2 ground 4" ground 4" ground 4" ground 40" field 40 fillicq 40 f				

	OBSERVATION WELL REI	JORI
DOJECT RMACOE MOTOR POC LOCATION SECTION 4 Date Completed 6/11/91 Originspected By H. MERRELL Checked By	inal Depth 15 Well No.	1 of 1 VESP-5A
Ground Elevation	Depth of surface seal below ground surface Type of surface seal: Concrete 1.D. of surface casing. Type of surface casing. Type of surface casing. Depth of surface casing below ground PROTECTIVE 1.D. of pipe. Type of riser pipe: 1" Schol 4D PVC Diameter of borehole Type of backfill: BEMONITE CHIPS Elev./depth top of seal. Type of seal: BENTONITE CHIPS Elev./depth bottom of seal. Type of sond pack. Elev./depth top of screened section. Type of screened section: 1" PVC Sand 40 Describe openings. D2D" Factor S/ok 1.D. of screened section. Elev./depth bottom of screened section.	2' B" Ift I' OD. 8" 2' 10' 10 12' 13' 15'

OBSERVATION WELL REPORT

OJECT RMACOE MOTOR F	OOL VES	89M114G1	Page of
DOCATION SECTION 4		(9948 WCFS)	Well No. VESP-5B
Date Completed 6/10/91 Or	iginal Depth	39'	
Inspected By H. MERRELL	Date		SCREEN
Checked By 6/10/91	Date		SCREEN 37'-36'

G	Ground Flush MOUNT PROTEC	TIVE COUER	
	levotion 10 and	seal below ground	2'
	Type of surface se	al: <u>CONCRETE</u>	
	I.D. of surface cas	ina	
	Type of surface co	osing:	
	1/4" NYLON TUE		
نسد	Depth of surface co		1fT
	PROTECTIVE		1" Q.D.
•	I. D. of pipe. Type of riser pipe:	1" Schol 40 PUC	
-			8"
Level	Diameter of borehold Type of backfill:	PEUTONITE to 2'	
	1	EDIOUTIC TO Z	į
Water	75 Type of backfill:	proul 10/3	29'
	Elev./depth top of		<u> </u>
gug	Side William I Flore Adopt hottom	of seal	34'
<u>~</u>	Elev./depth bottom	20-40 Silica Saus	
9	Depth of top of sand	pock	34'
Iraligraphy	1. Fley (death ton of so	reened section	36'
rai	Type of screened se	ction: /" PUC Janes 40	
S	Describe openings	20" Factor Slots	ł
ס	[E]	<u> </u>	/" O.D.
lize	I.D. of screened sect	ion. —	,
General	Elev./depth bottom	of screened section.\	37
95	Elev./depth bottom	of sand column. —	39'
ļ	Lice, ocpi		'

	OBSERVATION WELL	REPORT
LOCATION SECTION 4 Date Completed Ori	(9948 WCFS) ginal Depth 55	Page of well No. <u>VESP-5</u> C
Inspected By H. MERRELL	Date	SCREEN
Checked By	Dote De	epth Intervol 52-53
Elevotion Flesh Mount > Protective Cap B" diam 12: long 13' 13' 13' 13' 13' 13' 13' 13	Depth of surface seal below grousurface Type of surface casing. Type of surface casing. Type of surface casing. Type of surface casing. Type of surface casing below group of surface pipe. Type of surface casing below group of surface pipe. I.D. of screen of surface casing below group of surface pipe. Bentour 13 Bentour 13 Type of backfill: Group 44/2 Elev./depth top of seal. Type of sand pack. Elev./depth bottom of seal. Type of sand pack. Elev./depth top of screened section. Type of screened section: /" Puc Describe openings. D2D" Factor Surface of screened section. Elev./depth bottom of sand column. Elev./depth bottom of sand column.	8" EET und /ft /* OD. PUC 8" '-2' -/3' 44'/2 PS 50 50 52 SAU 40 5/04s /* O.D.
1	Fich's orbition as many	

	POMINCI	
PROJECT RMACOE MOTOR TO	(9948 WLFS)	Page of Well No. VESP-GA
LOCATION SECTION 4 Date Completed 6/13/91 Ori		Well No. VLST - GA
Inspected By H. MERRELL	ginal Depth	
	Doie	SCREEN 13-14'
Checked By		
,	YUSH MOUNT PROTECTIVE COVER	
Otomio ,)	TUSH PADOM TO TELL	
Elevation PINIENDINE TO THE		round 2'
0".12" -77	Type of surface seal: Concr	ete
Locking Flush Mount. Protective Cover		
Protective Cover	1.D. of surface casing. Type of surface casing: GALV.	SHEET
	1/4" NYLON TUBING	

	_ Depth of surface cosing below (PROTECTIVE	Jround
	Type of riser pipe: 1" Schol 41	0 PUC
	Type of riser pipe:	
	Diameter of borehole	
	7	
	Type of backfill: (BENTONITE)	
	1 5 11 54 455 01 5501	//DC
	Type of seal: BENTONITE C	11'
	Elev./depth bottom of seal. Type of sand pack. 20-40 Sil	100 SAUD
	Depth of top of sand pack.	
	Elev./depth top of screened section	n. <u>/3′</u>
	Type of screened section: /" Pu	C Johes 40
	Describe openings.020" Factor	5/04
	I.D. of screened section.	/" O.D.
		14
	Elev./depth bottom of screened se	ction.\
1:11(1)		
		15
	Elev. / depth bottom of sand column	n. —/3
1 原語		
	Flow (death of hele.	

	UBSERVATION WILL	L KLI OKI
DOJECT RMACOE MOTOR POLICATION SECTION 4- Date Completed 6/13/91 Original Inspected By H. MERRELL Checked By	(9948 WCFS) ginol Depth 44 Dote	Poge _ o1 Well No. VESP - 6 B SCREEN
Ground Elevation NININININININININININININININININININ	Depth of surface seal below gresurface Type of surface seal: Concre I.D. of surface casing. Type of surface casing. Type of surface casing. PROTECTIVE I.D. of Surface casing below gresurface. Depth of surface casing below gresurface. Type of surface casing below gresurface. Type of riser pipe. Type of riser pipe:	SHEET 8" SHEET 8" FOUND 15T 1" O.D. 2" 1/PS 40 5/ols 1" O.D. 1ion.\ 143

OBSERVATION WE	LL KLIOKI
DJECT RMACOE MOTOR POOL VES 89M114G1 LOCATION SECTION 4 (9948 WCFS) Dote Completed 6/12/91 Original Depth 58' Inspected By H. MERRELL Date Checked By Date	Page _ l ol _ l Well No. VESP-6C SCREEN Depth Interval 55-56
Ground Elevation Depth of surface seal below surface Type of surface casing. Gan. Locking Mash Mount. Photechic Cone I.D. of surface casing. Gan. 1.D. of surface casing. Gan. 1.D. of surface casing below I.D. of surface casing. I.D. of su	ground vet e U. SHEET Ground 1ft 1" QD. 40 PVC 8" CHIPS 53' Glica Sawa 53' Son. 55' VC Sheld 40 28' 1" O.D. section.) 56'

PROJECT RMACOE MOTOR POOL VES 89M 114-G1	Page
LOCATION SECTION 4 (9948 WCFS)	Well No. VESP-7A
Date Completed 6/2/91 Original Depth 15	
	SCREEN 13-14' Depth Intervol 13-14'
Checked By Date	Depin miervat 3 7
Ground Elevation Depth of surface seal below a surface Type of surface casing. Type of surface casing. Type of surface cosing that the pipe. Type of riser pipe: Type of sand pack. Elev./depth top of scal. Type of sand pack. Elev./depth top of scal. Type of sand pack. Elev./depth top of scal. Elev./depth top of scal. Type of scale. Elev./depth top of scal. Type of scale. Elev./depth top of scal. Type of scale. Elev./depth top of scale. Elev./depth top of scale. Elev./depth top of scale. Elev./depth top of scale. Elev./depth bottom of scale.	2' vete 8" SHEET Ground 1ft 1" OD. 21 CHIPS 10 11ca Sauro 10 12 VC Shelf 40 2' 1" OD. 3ection.\ 15

ODA	DERVATION WELL	e ner on i
anspected of	Depth 48	Page o1 _ well No. VESP- 7B SCREEN Depth Interval 45-46'
Elevation Elevation B" x / 2" Localing Aush Mounts Protective Cover 2	th of surface seal below graface e of surface seal: Concre of surface casing. of surface casing: GALU. NYLON TUBINCY The of surface casing below grafactive of surface casing. Adentation of seal. Of backfill: GRout 38-23' Adepth top of seal. Of seal: BENTONITE Characteristics of sond pack. Adepth top of sand pack. Adepth top of screened section. Adepth top of screened section. Adepth bottom of sand column adepth bottom of screened section. Adepth bottom of sand column adepth bottom adepth botto	SHEET 8" SHEET 8" FOUND 1 FT 1" QD. PUC 8" -2' 38 1/PS 43 43 45 Shel 40 Slock 1" O.D. 1ion.\ 48

PROJECT RMACOE MOTOR POLOCATION SECTION 4 Date Completed 6/11/91 Original MITERIES	ginal Depth	Page of Well No. <u>VESP-7C</u>
Inspected By H. MERRELL	Date De	SCREEN 56-55
Checked By	Date	
Ground Elevation B"x/2" Locking Alash Mount Protective Coner Anotective Coner Service of the service of th	Depth of surface seal below grousurface Type of surface seal: Concret 1. D. of surface casing. Type of surface casing. Type of surface casing. 1. D. of surface casing below grousurface. 1. D. of screenels. 1. D. of screenels. 1. D. of screenels. 1. D. of screened section. 1. D. of screened section.	### 8" SHEET 8" Und 1ft 1" O.D. PUC 8" -2 24 48 (PS 53 53 55 Shel 40 5/64 1" O.D. 56 ion.\ 58

	ODSERVATION WEEK	
DJECT RMACOE MOTOR POLLOCATION SECTION 4 Date Completed 6/13/91 Original Inspected By H. MERRELL Checked By	jinol Depth	Page of Well No. <u>VESP-8A</u> SCREEN Depth Interval/3'-/4'
Ground Elevation 8" x/2" Locking Flush Month Protective Cover 10 10 10 10 10 10 10 10 10 10 10 10 10 1	Depth of surface seal below graviface Type of surface seal: Concre 1.D. of surface casing. Type of surface casing: GALU. 1/4" NYLON TUBINCT Depth of surface casing below of PROTECTIVE 1.D. of Screeneds. Type of backfill: Rentouite Elev./depth top of seal. Type of seal: BENTONITE C. Elev./depth bottom of seal. Type of sand pack. Elev./depth top of screened section: I'' PU Describe openings. Describe openings. Describe openings. Describe openings. Describe section. Elev./depth bottom of screened section. Elev./depth bottom of screened section. Elev./depth bottom of screened section.	SHEET SHEET SHEET 1

OBSERVATION	WELL REPORT
OJECT RMACOE MOTOR POOL VES 89 M 1461 COCATION SECTION F (9948 WC Date Completed 6/13/91 Original Depth 45 Inspected By H. MERRELL Date Checked By Date	Page _ 1 of 1 FS) Well No. VESP-8B SCREEN Depth Interval 42-43'
Ground Elevation Depth of surface seal: Locking Flush Mount Protective Cove 1. D. of surface casing. Type of surface casing. Type of surface casing by NYLON TUBINCI L.D. of surface casing by NYLON TUBINCI Type of riser pipe: Type of seal: Elev./depth top of seal. Type of sand pack. Elev./depth bottom of seal. Type of screened section. Elev./depth bottom of screened section.	Concrete GALU. SHEET GALU. SHEET Selow ground IfT I" O.D. 8" TE CHIPS O SILICA SAND Section. I" PUC SALL 40 Factor Slots I" O.D. ened section.\ A5

	OBSERVATION WEL	L REPURI
Dote Completed 6/13/91 Or Inspected By H. MERRELL	(9948) WEFS iginal Depth Date	Poge of Well No. VESP - 8C SCREEN Death Interval 55-56
Checked By	Date	Depth Interval 55-56
	JUSH MOUNT PROTECTIVE COVER	round 2' ete 8" SHEET
Generalized Straligraphy and Water Le	Type of backfill: BENTOPITE Elev./depth top of seal. Type of seal: BENTONITE C Elev./depth bottom of seal. Type of sand pack. 20-40 Sil Depth of top of sand pack. Elev./depth top of screened section: I'' Pu Describe openings-020" Factor 1.D. of screened section. Elev./depth bottom of screened se	1/1/PS 53 1/1/PS 53 1/1/PS 53 1/1/PS 53 1/1/PS 1/1/PS 53 1/1/PS 1
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±	SAND, LT Yellow BRN (Munsell) 104R 4/4	•				1	- -	l]	
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PROJECT NO. 89M [14G] (Wes 9943)

SHEET___OF___

Woodward-Clyde Consultants PROJECT NAME RMA COE MOTOR TOOL VES HOLE NO. VESP-8A

(FEET)			C roe	- 6	÷ _ r	A	\mathbf{E}	_	B FMARKE
Ē	· DESCRIPTION	Lithology	Plezometer installation	Wote Conte	Pie tome! Data	Type Na	Recor.	Penetre Resist Blove 6 in)	REMARKS (Drill Mole, Fluid loss, Odor, etc)
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RING	LOCATION SEC 4						N AND	DAT	UM		
	IG AGENCY LAYNE ENVIRONMENTAL	DRILLER D. K	LERNER		DATE	FINI	RTED	6		3/9	1/6/13/91
ILLIN	G EQUIPMENT CME-75				į .		OH E		4		SAMPLER
ILLIN		DRILL BIT	8' ···		SA	IO. O	s i	DIST.			UNDIST.
	NO TYPE OF CASING / H Sched 40 PVC	•			W	ATER		FIRS	T		COMPL. 24 HRS.
PE 01	F PERFORATION FACTORY SLOTS . 020"	FROM 44	1043	FT.		GED					CHECKED BY
E AP	NO TYPE OF PACK 20-40 SILICASAND	FROM 45	10 40	FT.	77.	W.7	MER	RE	LL		
PE O	F SEAL BENTONITE CHIPS	FROM 40	TO /	FT							
\neg	Jan Land		GRAPH	IC LO		[Ł		_	LES	
FCCT)	DESCRIPTION	·	Lithology /	Piezo tratali	meter letion	Weter	Plezon Date	Type Ma	Recov, fl.	Penetra Resist (Bibwa)	REMARKS (Drill Rate, Fluid toss, Oder, et
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\pm	SXND LT Yellow	BEN					1	-	H		
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Ŧ	(Munsell) lDyR 4	44						-			
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Ŧ	(Munsell) 104R 4 Mg, Sobx- Moist, Poor GRAD	トラ	1 ./		I			-			
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FROJECT NO. 89 M 114 G (Wes 9948)

SHEET____OF__6_

Woodward-Ctycle Consultants PROJECT NAME RMA COE MOTOR POLL VES HOLE NO. VESP-88

		GRAPH		. 7	2			LES	
(FEET)	DESCRIPTION	Lithology	Pleasenator justal lation	Wate	Pie rome Dote	Type No.	Recor. 1	Panetra. Realst (Blove 6 in)	REMARKS (Drill Rule, Fluid loss, Odor, etc.
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PROJECT NO. 89 M 114-G1

(9948)

SHEET 2 OF 6

Woodward-Clyde Consultants PROJECT NAME RMACOE MOTOR POLYES HOLE NO. VESP-8 B

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0 E P T H	DESCRIPTION	Lithology	Plezometer Installation	Worle. Conten	Pierome Dofe	Type No.	Recor. f	Posts Bios 6 h)	REMARICS (Drill Rate, Fluid loss, Odor, etc)
16-	Cloyer Sond LT Yellow Ben	<i>.</i> /			10000	laaaalaa			
/7-	(Munsell) 104R 4/4 F-Cg				. 1				·
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PROJ	ест NO. <u>89М [14G]</u> (91	948)							SHECT <u>3</u> OF <u>4</u>

Woodward-Clyde Consultants PROJECT NAME RMACOE MOTOR POLL VES HOLE NOVEST-8 B

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24 (5 P) 23	(FEET)	DESCRIPTION	Lithology	Plezometer the tol lot lon	Water	Pie rome Data	Type Na	Recor. 11	Maria Bloss h)	REMARICS (Ortil Role, Fluid loss, Odor, etc
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PROJECT NO. 89M 1146-1

(9948)

SHEET 4 OF 6

Woodward-Chyde Consultants PROJECT NAME RMA COE MOTOR POOL VES HOLE NO. VESP-88

		GRAPHI	c roe		<u> </u>	5/	MP	LES	
OEPTH (FEET)	DESCRIPTION	Lithology	Plezometer Installation	Wote	Piezomet Data	Type Ma	Recor.	Panette Recist (Blove 6 in)	REMARKS (Drill Rule, Fluid loss, Odor, etc.)
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PROJECT NO. 89M/14G/

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SHEET 5 OF 6

Woodward-Clyde Consultants PROJECT NAME PMACOE MOTOR POOL VES HOLE NO. PO B

		GRAPH	c we	- =			PLES	REMARKS
(reet)	DESCRIPTION	Lithology	Plesometer testalistics	Conte	Plezone Dafe Type No.	Aecor.	Panette Biose Hose	(Drill Rale, Fluid loss, Odor, el
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LLING AGENCY LAYNE ENVIRONMENTAL DRILLER D. WERNER DATE FINISHED 6/13/91 - 6/18/91 LLING EQUIPMENT CME-75 LLING METHOD Hollow STEM Auger DRILL BIT 8" COMPLETION DEPTH 8" SAMPLER LLING METHOD Hollow STEM Auger DRILL BIT 8" NO. OF SAMPLES DIST. UNDIST. E AND TYPE OF CASING /" 5 Lod 4D PVC WATER FIRST COMPL 24 HRS. E OF PERFORATION FACTORY SLOTS. O ZO " FROM 56 TO 55 TT. LOGGED BY H.W. MERRELL E OF SEAL BENTONITE CHIPS FROM 58 TO 53 FT. OF SEAL BENTONITE CHIPS FROM 58 TO 53 FT. Hollowy Placements SEE SAMPLES REMARKS	DRING LOCATION SEC 4		- 1	ELEVATION AND DATUM								
LLING EQUIPMENT CME-75 LLING METHOD HOLLOW STEPN ALIGN E AND TYPE OF CASING II Sched 40 PVC E AND TYPE OF FACK 20-40 SILCA SAND E OF PERFORATION TE CHIPS FROM 56 TO 55TT LOGGED BY H.W. MERRELL CHECKED BY	D. WERNER		DATE	STA FINI	RTED SHED		6	13/9				
E AND TYPE OF PACK 20-40 SILCASAND FROM 56 TO 53-TT. E OF PERFORATION FACTORY SLOTS. OZD FROM 56 TO 53-TT. E AND TYPE OF PACK 20-40 SILCASAND FROM 58 TO 53-TT. E OF SEAL BENTONITE CHIPS FROM 53 TO 2 FT DESCRIPTION DESCRIP								\simeq	<u>8′</u>	1		
E AND TYPE OF CASING / Sched 40 PVC E OF PERFORATION FACTORY SLOTS. OZO " FROM 56 TO 55 TT. E AND TYPE OF PACK 20-40 SILICA SAND FROM 58 TO 53 FT. E OF SEAL BENTONITE CHIPS FROM 53 TO 2 FT CHECKED BY CHECK	RILLING METHOD Hollow STern Auger DRILL	BIT 8'		SAM). O	F S	DIST					
E OF PERFORATION FACTORY SLOTS. OZO "FROM 56 TO 53 TT H.W. MERRELL E AND TYPE OF PACK 20-40 SINGSAND FROM 58 TO 53 FT. E OF SEAL BENTONITE CHIPS DESCRIPTION DESCRIPTION LITHOLOGY PROTECTION DESCRIPTION LITHOLOGY PROTECTION DESCRIPTION THOM 58 TO 53 FT. H.W. MERRELL CHECKED BY CHECK	ZE AND TYPE OF CASING / 11 Sched 40 PVC			WA	LEV.		FIRS	iT		COMPL. 24 HRS.		
E AND TYPE OF PACK 20-40 SINGSAND FROM 58 TO 53FT. FROM 53 TO 2 FT GRAPHIC LOG Lithology Placementar Problem From 58 TO 53 FT. Lithology Placementar Problem From 58 TO 53 FT. Lithology Placementar Problem From 58 TO 53 FT. REMARKS (Drill Reta, Fluid tons, Oder, etc.) SAND LT YELLOW ISH BEN Munsell 10YR 4/4 F-149, Sub x - Sub Rnd Moist, Poor Gradel SL; Clayey	IPE OF PERFORATION FACTORY SLOTS . 020" FROM	56 ° 55	77.							CHECKED BY		
DESCRIPTION DESCR			FT.	77.4	4 ./	'(EK	KE,	LL				
DESCRIPTION Lithology Placometer to B a to the state of	PE OF SEAL RENTONITE CUIDS FROM	53 ° 2	FT									
SAND LT Yellow ish Ben (Munsell) 104R 4/4 F-14g, Subx-Sub 2nd Moist, Poor Gradel SLi Cleyey		GRAPH	C LOC		_	2	S.	MP	LES			
SAND LT Yellow ish BeN (Munsell) 104R 4/4 F-14g, Sub x-Sub Rnd Moist, Poor Gradel SLi Cleyey	DESCRIPTION	Lithology		eter		E -	ž	딝	E # 8 3	REMARKS		
F-14g, Subx-Sub End Moist, Poor Gradel SLi Cleyey	DESCRIPTION .		instelle	HOR!	8	ž	£	٤	£ & @ •	(Utili Maw, Falla Was, Oder, etc.)		
F-14g, Subx-Sub End Moist, Poor Gradel SLi Cleyey	+			\Box				П				
F-14g, Subx-Sub End Moist, Poor Gradel SLi Cleyey	I SAND IT VOLLY A	ا - ا رړ				1	-	П				
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F-14g, Subx-Sub End Moist, Poor Gradel SLi Cleyey	I (MUNCH) LOVE ALA			- 1		1	-	H				
F-14g, Subx-Sub End Moist, Poor Gradel SLi Cleyey	1 (Marsar) 101x 4/4	`. '			- 1	1	•					
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Woodward-Clyde Consultants PROJECT NAME RMA COE MOTORTOL VES HOLE NO. VESP-8C

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PROJECT NO. 89 M 114-G1

(9948)

SHEET 2 OF 7

Woodward-Clyde Consultants PROJECT NAME RMACOE MOTOR POLL VES HOLE NO. VESP-BC

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DEPTH (FEET)	DESCRIPTION	Lithology	Pleasmeter Installetion	Woter	Pierome Date	Type No.	Recor. f	Penetra Resist Blove 6 in)	REMARKS (Drill Rate, Fluid loss, Odor, etc)
17	Clayey SAND LT Yellow BRN Munsell 10 YR 4/4 F-Cg , Sub & Sub Rus. Moist , Poorly GRADID	 	·		11,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1				
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PF. DJECT NO. 89M 114G1

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SHEET 3 OF Z

Woodward-Clyde Consultants PROJECT NAME RMACOE MOTOR POL VES HOLE NOVESP-BC

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OEPTH (FEET)	DESCRIPTION	Lithology	Plezometer metal lation	Wete	Pletonel Dala Type No.	150	Penetra Relat Biora 6 h)	(Orill Role, Fluid loss, Odor, etc)
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PROJECT NO. 89M 1146-1

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SHEET 4 OF 7

Woodward-Ctycle Consultants PROJECT NAME RMA COE MOTOR POLL VES HOLE NO. VESP-8C

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OEPTH (FEET)	DESCRIPTION	Lithology	Plezometer Inetaliation	Water	Piezonet Dafe	Type Na	Recor. ft	Parette. Resist Biose 6 h)	REMARICS (Drill Rele, Fluid loss, Odor, etc)
35+	/ SP)		,						
36									
37+	Clayey Sand LT Yellow BEN								
38 +	(SP)								
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40	Sondy, Clay Lt yellow BEN Fg, Sub 4-Sub rd 1% Gr.+. ECLAY (SC/CL)								
A + + + + + + + + + + + + + + + + + + +	ÉCLEY (SC/CL)								
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PROJECT NO. 89M/14G/

(9948)

SHEET 5 OF 7

Woodward-Clyde Consultants PROJECT NAME PMACOE MOTOR POOL VES HOLE NO. ESP-8C

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OEPTH (FEET)	DESCRIPTION	Lithology	Pleasmeter the foliation	Water Conten	Pietomet Dafe	Type Na.	Recor, ft	Panetre Relet Bloss (n. n.)	REMARKS (Drill Role, Fluid loss, Odor, etc)
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16	SAND Sci Clayey				1	-			
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4-7	- Poor Gredd Mois'-				4	-			
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		GRAPHI	c LOG		<u> </u>		_	LES	
OEPTH (FEET)	DESCRIPTION	Lithology	Plesometer tretolicitor	Water	Plezometer Date	Type Ha	Recor. ft	Panist Biora 6 h)	REMARKS (Drill Role, Fluid toss, Odor,etc)
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34	Clayer SAND 27 Yell-BRU F-GJ Sub 4-Sub Rnd 10-6 Fines, Low plastic TR grit.				1	-			
‡	F-CZ 5-54-54 Pal					-			
士	10% times, Low plastic	1./							
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	NO. 89M114G1	(_		SHEET 7 OF

Foodward-Clyde Consultants ORING 'LOCATION Sec 4 RMA			ELEVATION AND DATUM							
RILLING AGENCY Layne Western	DRILLER \mathcal{D} .	WERNE	<i>D</i> [2.5]	E ST	EMEN	~ ~	0/0	6/	9/—	6/4/91
RILLING EQUIPMENT CME 75		10/20	D (CO	MPLET					SAMPLER	
RILLING METHOD WORKER Stem	DRILL BIT	0/4 1	D ,	NO. C	F	DIST	•	i	UNDIST.	
ZE AND TYPE OF CASING 4 PUC S	iched 40			WATE		FIRS	7		COMPL	24 HRS.
PE OF PERFORATION . 020	FROM 28	10 /3		GGED					CHECKED BY	1
ZE AND TYPE OF PACK SENT . 6-0	FROM 30	το //	FT. F1	· W./	ME	RRE	ELL			
IPE OF SEAL Bentonita	FROM //	70 5.5	FT							
			IC LOG	1.	1	3	MPLE	\$		
DESCRIPTION		Lithology	Piezomete		£ .	2	집	6 14 14 14 14 14 14 14 14 14 14 14 14 14	RE	MARKS
			inotel letie	1-8	200	£	8 4	ŧğ•		hid loss, Oder, etc
+ 2 inch onevel 2"c	leep at	000					П		Groves+	ov RR
2 inch grevel 2"C Serface Gray Volc.	(Relliest)	1.1		1		E	П		06116	<i>ic</i> / '
		19/	50		-	F				
I Clayer Clayer Sond, +	Megnin	//		1	:	F				
I Simcacesus, Poor Good	ed Sult	1/ . /	}		:	F				
I Sand 90%, moisti	-) ~~	1://			-	F				•
Sand 90%, moists Mensell 10 YI	e 3/a	/ .			:	F			ļ ·	
+ 1 201		1./			=	F				
I dark yellowish Bro	own				:	†				
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		GRAPH	IC LOG	. =	ž	5/	MI	LES	
0EPTH (PE ET)	DESCRIPTION	Lithology	Plezometer tnetoligities	Conte	Plexome Date	Type No	Recor. f	Panette Regist 6 h)	REMARKS (Orill Role, Fluid loss, Odor, etc)
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<i>,</i> ,]	<u>.</u>	./.]	Ė			·
10	- Cloyer Sand, Dark yellow brown	. /	1			Ė			
4	- Muscall lava 21. Th	./.			-	-			
.]	- Cloyer Sand, Dark yellow brown - Munsell 1042 3/4, F-Mgr.	(/	1			ţ			
<i>n</i> -	Sub & - Sub rnd, Poor Gooded	,/.		l	-	+			
-	Sti Micaceurs, moist,		ł	ł	3	Ė			
F	cley 25% (SC)					Ė			
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4	- -	<i>[.</i> ·			-	F			
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Woodward-Clyde Consultants PROJECT NAME RMACOE MOTOR Paul VES HOLE NO. VES-3

	Ward-Ciyue Consultants Project NAME	GRAPH	ic roe	. =	} [SA	MP	LES	_
E	DESCRIPTION	Lithology	Pleasmeter metalistics	Woter	Piezome Date	Type Ma	Recor. (1	Penatra Releat 6 h)	REMARICS (Drill Rate, Fluid loss, Odor, etc.)
14-	CloyegSAND, LT Yelberish Brown, Munsell 101/R3/4 Most, F-Mg Sand,		·			-			
18	Most, F-Mg Sand, Sub 4-Sub and, Sci Micareous (SC)	/. ./.							
/9	- Sci amount y 16-14" gr.t. 196±								
	Clayer Sand as about				1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				
21	- -								
22-	TE Clay balls								
24	10 y R 4/4 TR 1/4-1/8" grit					+ + + + + + + + + + + + + + + + + + + +			
25-	CT NO. <u>B9M 114-61</u> (9948								SHEET 3 OF

Woodward-Clyde Consultants PROJECT NAME PMACOE MOTOR POOLUES HOLE NO. VES-4

_	TWART-CIYOF CORBUILDINGS PROJECT NAME	GRAPHI	ic Los		<u>.</u> 1	54	MP	LES .	
OEPTH (FEET)	DESCRIPTION	Lithology	Piezometer Installet las	Water Content	Pierometr Date	Type Na	Recor. fi	Penate Relat Blove 6 in)	REMARKS (Orill Role, Fluid loss, Odor, etc.)
25-	Clayer Sand LT Malow BED 10 YR 34 (Munser) Moist, F-Mg Sand, Sub Rudel; Life line grained	`.'/ :/. . 'y							
27	Rubel; the fine grained Subornel grit 1/4" & Fg ground up to 1/2" (2-3%).				1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0				·
28		/			1				
29									·
30-	T.D	/			1,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	بالمتناء المتنالية بالمتناء			Nothing above Buckground of 0-2 ppm on P.I.D.

PROJECT NO. 89 M 114-G1

(9948)

SHEET 4 OF 4

BORING	Iward-Clyde Consultants P				ELEV	AT IO	H AND	DAT	UM	l .	•
DRILLIN	IG AGENCY Layne Western	DRILLERD.	Wern	00	DATE			6	7	7/91	7
DRILLIN	G EQUIPMENT CALE TE	1	101/20		COMP	LETI	ON C	EPTH	6	20	SAMPLER
DRILLIN	G METHOD Hollow Stem Auge	DRILL BIT	6/4 1		N(0. 01	F	DIST.			UNDIST.
SIZE AP	NO TYPE OF CASING 4" PUC	<u> </u>	W172 1	-	W	TER		FIRS	Ť		COMPL. 24 HRS.
		FROM 58	1043	FT.	LOGG	ED					CHECKED BY
	ND TYPE, OF PACK Sond 6.9-	<u> </u>									
TYPE O		15004	300								
TIPE O	Benjonite	40	<u></u>					-	ù a	LES	
EF				IIC LOC		3 =	£ .	4	2	4430	REMARKS
DEPTH FEET)	DESCRIPTION		Lithology	Plezon tretelic	otion :	8	28	1776	ğ	Penatr Rest (Blow n	(Drill Rate, Fluid loss, Odor, etc
					┵			-	۳	2	
‡	2" Volc. Grovel (R.F. Bo	allost)	200	1	ı	- 1]				•
‡	2" Soil BLE - DEGY						-	_	Н		
‡	-		' '			Ì	1	F			
‡	Clave C. & Dans Valle	ROW	'/				1				
/ 土	Clayer Sand, DARK Yello	w ~~	/ /.			1	4	-			
±	Munsell 104R 4/4	_	. .	1				-			·
1			1. /	1			‡				
王	F-Mg, Sub 4-Su	6 Rnd.		1			-	-		1	
I			/ .	ł	- [-		•	
J	Moist. Less than	5%		1			-	L		1	•
14 T	· · · · · · · · · · · · · · · · · · ·	01	1 . /	1							
‡	fines. Non Plastic	CICY	/		- 1		}	-			
干	moterial c		\vee	1		1	-	-			
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‡	- Clay Ince. to 21	10%					3	E		Ì	
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167	- SLIMORE plastic			1			-	-			
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Woodward-Clyde Consultants PROJECT NAME RHA MOTOR POLVES HOLE NO. VES-4

		GRAPH		. =	<u>}</u>	S/	M	r ES	
0EPTH (FEET)	DESCRIPTION	Lithology	Plezometer tretoilation	wote. Conter	Piezome Dafa	Type No	Recor. 1	Penetra Resist Bione 6 In)	REMARKS (Drill Male, Fluid loss, Odor, etc)
11 -	Cleyey Sand, DRK Yellow BROWN (Munsell 104R 4/4 Med-Coarse grained, Sub & - Sub End, Very Shi crownt of fines (5%) Moist (SC)	Lithology		Water	Piezoneter	50 000 0d.4	Necot, 73 K	There is a second of the secon	
14		// /				,			
15-					-				

PROJECT NO. 9948 89M114G1

SHEET 2 OF 7

Woodward-Clyde Consultants PROJECT NAME RAID MOTOR POUL VES CEHOLE NO. VES -4

		GRAPH	C TOC	-	3	S/	MF	LES :	
0EPTH (FEET)	DESCRIPTION	Lithology	Plezometer Inetal lation	Wate Contai	Piezome Date	Type No	Recor. 1	Penetra Regist Blows 6 in)	REMARKS (Drill Rele, Fluid loss, Odor, etc
16-		• .			4	-			
1	Sand Med, Course Cor				1		П		•
7			,		1	-	П		
.]	Sub &, Sub Rad, Pau Sout				4	-	П		
7	with 5% FineGravel				1	-			
- ‡		. ,			1	1			·
7	316-1/4" Sub raded gr				1	-			
/B	Poorly Sorteb	, .`]	-			
1	1 2	. 0 .			1				
3	moist. (SP)	/							
- 1		·/.							
19 =	<u>.</u>				-				·
4									
4		/				-			
		/				-			
<i>10</i> -	Sand DK Rod Yellow BRN	· . ·			1	-			
}	Munsell WYK 4/4	0.]	-			
4	Thensell wy 12 1/4	, ·				-			
21 <u>-</u>	Sond, Med-Coavergr	• •				_			
	Sub 4 - Sub Rnd.	١.							
7		•,	_						
- 1	10% Fine gravel 18"-	-]				
22-	1/2" - Subrad W/ BAK	0			-	-			
4	Staining Ground Frags.	•]				
1	No Odor, Moist	- ,			-				
]	(sP)								
23-							ĺ		
1		0.				Ė			
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24-)] =	E			
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PO 15	CT NO. 9948 89M 114 GI	,							SHEET 3 OF

Woodward-Clyde Consultants PROJECT NAME PACOE Motor Paul VES HOLE NO. VES-4

	iward-Clyde Consultants PROJECT NAME	GRAPH	IC LOG	_	1	S/	MP	LES	
(reer)	DESCRIPTION	Lithology	Plezometer tretoi lat los	Weder Content	Plerometr Date	4	E	Penetra Regist Blows 6 in)	REMARICS (Drill Rele, Fluid loss, Odor, etc)
25-	Sand DK Yellow BEN				1	- - -			
24	C-VC grained, 5464- Sub Rnd, Moist:; your Fine Grovel 18-14" Sub Rnd. (20%)	0							۱.
27	506 Rnd. (20%) (5 P)	0							
28 -	- (0							
29					1				
30-		0							
20		0.			*				
31	-								
32-					-				
33-	Sond, DK BRN, F-Mgr. Munsey 104R 4/3, Moist 15% FrancGrowel 4-1/2"	00			-	 			Drig 5/2web at 33.
34	9948 (44.65) 8911	00.				<u> </u>			SHEFT 4 OF 7

Woodward-Clyde Consultants PROJECT NAME EMACOF Motor Pool VESHOLE NO. VES-4

		GRAPHIC LOG			3 [54	MP	LES			
	DESCRIPTION	Lithology	Pleasmeter metalistics	Water Content	Pieromet Date	Type Na.	Recor. ft	Manie Belon 6 (8 6)	REMARKS (Ortil Rais, Fluid loss, Odor, etc)		
34-	Sond DEBON F-Mg maist, Sub X- Sub Rnd	00			-	-					
	10% Gravel 44-318 raysub Rd		·			-					
35-											
		• • •				-					
36	Clayer Sand DK Yellow BRN	.//				- - -					
	Munsell 104K 4/4	11.			1	-					
31-	Silty Mixtures (SM/8E)(ML)	11:				- - -			·		
	fines = 10-15%	11.			1						
9 e-	Sond F-Mg-Cg	///-			1 4	-					
-	with occasional "e" grit.	1//			1						
39-		4!:			1						
-					1 1 1						
40-		[.\\.			1111						
	Clayey Sand DK. Yell. BEN				1 1						
41 -	F-Mg, Sub x-Sub End	/ <u>[]</u>			1						
	fen 1/3" grit grains	(1:.)				<u></u>					
42	‡ + -					_			,		
٣.	(SC)/(ML)	. . /	,		-	<u> </u>					
43.	‡ †	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\				_					

PROJECT NO. 9948 (WLFS) 89M114G1

SHEET 5 OF 7

Woodward-Clyde Consultants PROJECT NAME PHACOE HOTOL VES HOLE NO. VES-4

		GRAPH	IC LOG	. =	<u> </u>	SA	MP	LES	
DEPTH (FEET)	DESCRIPTION	Lithology	Pleasmeter testel istica	Woder Conten	Ple zome Dofe	Type No.	tecor. ft	Real of 15 (15 to 15 to	REMARICS (Dritt Rate, Fluid toss, Odor, etc)
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4		/ .				-			
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مدر					-				
75 . :	Clayer S. Hy SAND De Yellow BRN.	· ·							
-	DE Vellow ROW				-	_			
	}	1/_						ł	
4	Munsell 104R 4/4	/ .			1	-			
	F-C grained Sub End.	• ,			1	-			
	<u> </u>	0/		Ì		Ē			
: - ر <i>ی</i>	Moist. Fines = (10-15-%) Formul 1/8-3/8" (20/6)	/.				-			
7	FINES = (10 -13 11)								
-	F Gravel 1/8-3/8" (20/0)				-				
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PROJECT NO. 9948 (WCFS) 89M11461

SHEET 6 OF 7

Woodward-Clyde Consultants PROJECT NAMERA COF Motor Puol VES HOLE NO. VES-4

	ward-Cryde Collaboration	GRAPH	c LOG		\$ [SA	MPL	ES_	
0 (FEET)	DESCRIPTION	Lithology	Piezometer Installation	Conten	Plezomet Date	Type Na.	Recor. ft	Release Bloss h)	REMARKS (Drill Role, Fluid loss, Odor, etc)
1 1	Clayey Sity Sond OK Yellow Ben 10 YR 4/4 (Munsell)								
54	-Sub K. Moist. Little Fine Gravel 18-14" Sub Rad.	/							·
ا ا	(5c)	0.			1,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	l i i i i da i ada i a a ad			
57 58		, , , / . , .							
59-	7.D 60'								
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PROJECT NO. 9848 (WES) 89M 114G1

SHEET Z OF Z

PRILLE REPORT CASE TO THE PROPERTY OF THE STATE OF THE ST	Voodward-Clyde Consultants Propries				ELEV	AT IO	N AND	DAT	UM		
SALD, Clopen, LTVellowBed SALD, Clopen, LTVellowBed Formation Description Descr	PRILLING AGENCY Layne Environmental	DRILLER D.	WEEN	EX	DATE	FINE	MTED SHED	6/		191	
SAUPLES SIZE AND TYPE OF CASING 1" PUC FACT SIN'S OD FROM 13 TO 12 FT. LIGGED BY WATER ELEV. TYPE OF PERFORATION 1" PUC FACT SIN'S OD FROM 15 TO 10 FT. SIZE AND TYPE OF PACK SINCA 20-40 FROM 15 TO 10 FT. LIMbology Placomotor restulation of E. B. S. S. S. S. S. S. S. S. S. S. S. S. S.	LME /								_/	5	
THE OF PERFORATION 11 PUC FACT SIDES ON 15 TO 10 FT. LOGGED BY WITHER OF PERFORATION 11 PUC FACT SIDES ON 15 TO 10 FT. LOGGED BY WITHER OF SEAL BEATON. TE DESCRIPTION	1-101/02 318M 71498	DRILL BIT	<u>8"</u>		SA	MPLE	<u>S</u>				
SAND, Cloyen, LT Yellow Ben. FAME, Subx-Subx-Sub Rad. FROM Company of the control of the contr	, , , ,							FIRS			<u> </u>
TYPE OF SEAL BENDON, TE DESCRIPTION DESCRI	TYPE OF PERFORATION I" PUC Fact State 020	FROM /3			4	L).	ME	CR	E	4	CHECKED BI
DESCRIPTION Lithology Placometer with letter Placement with lette	ize and type of Pack Silica 20-40	100011									
DESCRIPTION Lithology Placometer with letter Placement with lette	YPE OF SEAL Benton. te	FROM 10	2								
SAND, Cloyen, LT YellowBer 1 F-Mg, Subx-Scho Rnd SLi Amant of Cloy. Moist (SC)	•					5 5	ŧ.	4			REMARKS
SAND, Cloyen, LT YellowBer 1 F-Mg, Subx-Sub Rnd Sui Amount of Cloy. Moist (SC)	DESCRIPTION		Lithology		etion	₹ Š	28	2	\$	Post Boar 6 In	(Drill Rate, Fluid toss, Odor, etc.
$\begin{array}{c c} \hline & (SC) \\ \hline & \vdots \\ \hline & \vdots \end{array}$				 			_		۴		
$\begin{array}{c c} \hline & (SC) \\ \hline & \vdots \\ \hline & \vdots \end{array}$	‡		1'/.				1				
$\begin{array}{c c} \hline & (SC) \\ \hline & \vdots \\ \hline & \vdots \end{array}$	Ŧ		V .		ļ		1	<u>.</u>	1		
$\begin{array}{c c} \hline & (SC) \\ \hline & \vdots \\ \hline & \vdots \end{array}$	Ŧ		1			I	Ì				
$\begin{array}{c c} \hline & (SC) \\ \hline & \vdots \\ \hline & \vdots \end{array}$	I DAND, Cloyen, LTY	ellow Ben	. '				1	:			
$\begin{array}{c c} \hline & (SC) \\ \hline & \vdots \\ \hline & \vdots \end{array}$	1 + EM. CUE	1	1 /]	$\frac{1}{2}$	-			
$\begin{array}{c c} \hline & (SC) \\ \hline & \vdots \\ \hline & \vdots \end{array}$	1 = 1-17g) Sub2-Sch	Pndr					1		١		
$\begin{array}{c c} \hline & (SC) \\ \hline & \vdots \\ \hline & \vdots \end{array}$	+ Si Kan Salaka		1, "				\pm				
$\begin{array}{c c} \hline & (SC) \\ \hline & \vdots \\ \hline & \vdots \end{array}$	+ Ser Amount of City,						\exists	-			•
$\begin{array}{c c} \hline & (SC) \\ \hline & \vdots \\ \hline & \vdots \end{array}$	# Most		,			ı	I		ļ		
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		GRAPHI	c roe	-	}	\$4	MP	LES	
OF PERSON	· DESCRIPTION	Lithology	Pleasmeter metalistiss	Woter	Plezone) Dote	Type Ma	Recov. ft	2 2 2 0 0 2 2 2 2 0 0	REMARKS (Drill Role, Fluid loss, Odor, etc)
7-	45 BBook	/	,			lecale			
8	(Sc)	/.·			1 1	المستعادي			
9	-	· .							
10	SAND, LT Yellow BRN, SUB 4-Sub Rnd, Moist Poor-Graded							-	
1	·	• .							
12	(SP)				la castrati	l e e e e e e e e e e e e e			
13									
/4									
المحرا	T.O.								
PROJE	ECT NO. WCC 89M114G1 (9948)			<u> </u>			SHEET 2 OF 2

RING L	ocation Sec 4	A de Fori			EL	VATIO	N AN	DAT	UM		S WEHOLE NESPS
	AGENCY /COLD	Environ ment	G/ DRILLERD 4	Jemer	DA'	E ST	SHED	W	11	0/1	·
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Woodward-Clyde Consultants PROJECT NAME RM4CDE Hoto-Po-1 VES HOLE NO. VESP-5B

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Woodward-Clyde Consultants PROJECT NAME RMA COE Hoto & Fol VES HOLE NO. ST

- 1		GRAPH	C LOG		}	5/	_	LES	
(FEET)	DESCRIPTION	Lithology	Pleasemeter Installation	Woler Conten	Dote	Type Ma.	Ę į	Pace Pace Pace Pace Pace Pace Pace Pace	REMARKS (Orill Rule, Fluid loss, Odor, e
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	End ht yellow BEN F-Mg, Sub K-Sib R	/				‡			
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Woodward-Chyde Consultants PROJECT NAME EHA COE Motor Pool UES HOLE NO. ______

		GRAPH	C LOG		3	\$4	M	Y.ES	
DE SE		Lithology	Plazometer matel letter	Weter Content	Plezomete Date	Type Ma	Recor. ft	Principle Relief 6 In)	REMARICS (Drill Role, Fluid loss, Odor, etc)
24	Sour LT yellow BEN		·		11	- - - -			
20	Sour LT yellow BEN Munsell) 104R 4/4 F-Cq moist. Subx-Sub Rnd.				1 1				
27	(SP)	•							
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31	CLAMEY, SILTY SANTO, LT Yellow BRU, Moist Sub4-Sub End.	<u>//.</u>							
32	(Sc)(ML)	·//·							
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PROJECT NO. 89M [146]

(9948)

SHEET 4 OF 5

Woodward-Clyde Consultants PROJECT NAME PMA COE MORREDOL VES HOLE NO. VEST-5B

T		GRAPH	C LOG	. 2	<u> </u>		MP	ሊES	80410
	DESCRIPTION	Lithology	Piezometer Inetal lation	Woler Content	Piezom. Date	Type Ma.	Recor, f	Page Regist 6 5)	REMARKS (Orill Rule, Fluid loss, Odor, etc.)
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Woodward-Clyde Consultants PROJECT NAME MOTOR POLAREA VEP COEHOLE NO. VESP-5C BORING LOCATIONSchool & RMA DATE STARTED 6/10/91 ENVIRDIMENTA DRILLERD. WERNER COMPLETION DEPTH DIST. UNDIST. DRILL BIT Auger COMPL. 24 HRS. WATER ELEV. SIZE AND TYPE OF CASING /" PUC CHECKED BY H. Merrell TYPE OF PERFORATION FACT. Slots .020" ¹⁰ 50 SIZE AND TYPE OF PACK 20/40 SilvaSno TO 445 FT TYPE OF SEAL Chips GRAPHIC LOG DEPTH FEET) REMARKS DESCRIPTION Lithology (Drill Rate, Fluid toss, Oder, etc.) TRACE (2"+) BLK Soil & Balkst 25/ Grave! 4. SAUD, LT Yellow BAN, (Munsell) 104R 4/4 F-Mg, Sub rnd, Sub 4, mast. TR fines (50)

PROJECT NO. RMA COE B9MIAGI (WCC); 9948 WCFS

SHEET___OF__7

Woodward-Chyde Consultants PROJECT NAME _____

<u></u>		GRAPH		. =	}	\$4	MP	LES	
	DESCRIPTION	Lithology	Plesometer tnetolistion	Conten	Pierome Date	Type Ha	Recor. f	Panere Relat Biore 6 E)	REMARKS (Drill Rais, Fluid loss, Odor, etc)
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W	SAND LT YELLOW BRN (MINSULL) DYR 4/x					-			
	(Munsell) 10 yr 4/r F-Mg, Subral-Sub & Mast, Poorly graded				:	-			
\int_{λ}	Mast, Poorly graded					-			
	 								
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PROJECT NO. 89M 11461

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SHEET 2 OF Z

Woodward-Clyde Consultants PROJECT NAME RMACOE MOTOR POOL VES HOLE NO. VESP-5C

		GRAPH	C LOG		3	54	MP	LES	Bentbac
(reet)	DESCRIPTION	Lithology	Plexometer sectol let los	Wote Conte	Plezon	Type M	Recor.	Penetra Resist Bloss 6 h)	REMARKS (Drill Male, Fluid loss, Odor, etc
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Woodward-Clyde Consultants PROJECT NAME PMACOE Motor Pol VES HOLE NO. VESP-50

	d-Clyde Consultants F		IC LOG		1			LES	
(FEET)	DESCRIPTION	Lithology	Piesometer inetaliation	Weter Conten	Pierome Date	Type Ma.	Recor. fi	Resistant (REMARKS (Drill Male, Fluid loss, Odor, etc)
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Woodward-Clyde Consultants PROJECT NAME RMACOE Mole POL VES HOLE NO. VESP-5C

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PROJECT NO. 89M11461 (9948)

SHEET 5 OF L

Woodward-Clyde Consultants PROJECT NAME RMACOE NOTOR TOOL UES HOLE NO. VESP-5C

—т		GRAPH	c roe	. =	}	54	MP	LES	
(FEET)	DESCRIPTION	Lithology	Plezometer the tolicitor	Wole Conte	Piezome Dote	Type Na.	Recor.	Bala Bala Figure	REMARKS (Drill Role, Fluid loss, Odor, etc
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PROJECT NO. <u>89 M 114-61</u> (9948)

SHEET 6 OF 7

Woodward-Clyde Consultants PROJECT NAME PHACOE MOTOR POL VES HOLE NO. VESP-5C

		GRAPH	ic roe	- E	ŧ.,		UPLES	REMARKS
(FEET)	DESCRIPTION	Lithology	Plezometer Installigition	Wote Conte	Pleton	Type Na	Parate Belst Figure 1	(Orill Rule, Fluid loss, Odor, etc
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Woodward-Clyde Consultants PROJECT NAME COE MOTOR POL VES HOLE NO.VESP-6A BORING LOCATION SEC DRILLING AGENCY LAYNE ENVIRONMENTAL DRILLER D. WERNER DRILLING EQUIPMENT CME-75 DRILLING METHOD HOWAN STEM ALGER DRILL BIT UNDIST. SIZE AND TYPE OF CASING / " Sched 40 PVC COMPL TYPE OF PERFORATION FACTORY SLOTS . 020 " FROM FT. LOGGED BY CHECKED BY H.W. MERRELL SIZE AND TYPE OF PACK 20-40 SILCA SAND TYPE OF SEAL BENTONITE CHIPS 01 REMARKS DESCRIPTION (Drill Rate, Fluid loss, Oder, etc.) SANDI SLI CKYLY LT Yellow Bea (Munsell) 10 YR 4/4 F-Mg, Sub4-Sub END Moist, POORLY GRADED

Woodward-Clyde Consultants PROJECT NAME RMA COE MOTOR POLL VES HOLE NO. VESP-GA

	GRAPHIC LOG						54	MP	LES	
(FE 1)	DESCRIPTION	Lit	hology	C LOG Pleasmeter Installation	Conten	Pierome Date	Type Na.	Recor, ft	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	REMARKS (Drill Rate, Fluid loss, Odor, etc.)
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PROJECT NO. 89 M 114-G1

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SHEET 2 OF 2

RING	LOCATION SEC 4				ELEV	/AT 10	N AND	DAT	UM		•		
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ILLIN	G EQUIPMENT CME-75				COMI	PLETI	OH D	EPTH		14	SAMPLER		
ILLIN	G METHOD HOLLOW STEM Auger	DRILL BIT	8'			IO. O MPLE		DIST.		UNDIST.			
IZE AND TYPE OF CASING / " Sched 40 PVC						ATEF		FIRS	<u> </u>		COMPL	24 HRS.	
PE O	14G0M3C013 1020	FROM 43	10 42	_ FT.		GEO W. J	by MER	PE	,,		CHECKED B),T	
ZE A	NO TYPE OF PACK 20-40 SILICA SAND	FROM 44		_	,,,	••••	14. (•		
PE O	F SEAL BENTONITE CHIPS	FROM 40	10 2	FT									
			GRAP	IC LO		= =	ě.		_	423~	R	EMARKS	
(LEEL)	DESCRIPTION		Lithology	Piezo tratali	elion	Weter	8	1778	Recorft	Boatra (Boatra E In)	(Drill Rate, I	Fluid toss, Oder, e	
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#	SAND SLI Clayey Lt yellow BRN (Munsul) 104R F-Mg, Suba-Sub Moist, Poor Bra	,					-]	-					
‡	(Munsell) 104R	4/4						-					
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Woodward-Clyde Consultants PROJECT NAME RMA COE MOTOR TOOL VES HOLE NO. VESP-68

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(reet)	DESCRIPTION	Lithology	Plezometer Installation	Ço €	Ple rome Defe	Type No.	Recor.	2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	REMARKS (Ortil Rate, Fluid less, Odor, etc.)
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Woodward-Clyde Consultants PROJECT NAME RMACOE MOTOR POLL VES HOLE NO. VESP-68

	T	GRAPH	C LOG	اءِ	<u> </u>		MP	763	
(FEET)	DESCRIPTION	Lithology	Pleasmeter anetal lation	Wote. Conter	Piezomet Dafe	Type No	Recor.	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	REMARKS (Drill Role, Fluid loss, Odor, etc
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	SAND, Growly LT Yellow BRN (Munsell) 104R 4/4 F-Mg - TE 1/8" Growd F-Mg - Sab 4 MOIST. POORLY GRADED				-	‡			
	H YEINW BREET					Ŧ			
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7	+ 1-Mg - 10 /8 6400	1 '				‡			
	I F-Mg-5ab 4	\ \ ,		1	-	-			
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PROJECT NO. 89M 14G1

(9948)

SHEET 3 OF 5

Woodward-Clyde Consultants PROJECT NAME RMACOE MOTOR POL VES HOLE NOVESP-68

DESCRIPTION LINDSON PRODUCTION LINDSON PRODUCTION SAMPLES REMARKS REMA	s, Odor, et
(SP)	
SAND LTYELLOWBEN	
SAND LTYENDUBEN !!	
1 JANU ~ 1 YELOWO C~ +	
SAND LTYELLOWBEN F-Cg, S64-S6 Rus	
I 4 / Paul Gardek 1 1 1 1	
Ta va" Groved	
1 / x 14 6 room +	
2\$ (Sp) \$\frac{1}{2} \frac{1}{2}	
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PROJECT NO. <u>89M 114 6-1</u>

(9948)

SHEET 4 OF 5

Woodward-Clyde Consultants PROJECT NAME RMA COE MOTOR POOL VES HOLE NO. VESP-68

		GRAPHI	c roe	2 6	ŧ		WPLES	REMARKS
TEE (1)	DESCRIPTION	Lithology	Plezometer Installation	Wete	Piezomet Data	7 9 2	Perce. Peretre. Blows 6 h)	(Drill Role, Fluid loss, Odor, etc.
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+ F-Mg	, Sub &-Suh Poorly Greden	K	,		‡	-	1	
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PROJECT NO. 89	M[14G]	7948)						SHEET 5 OF

RING	ward-Clyde Consultants PROJECT N			ELEV	/AT IO	N AN	, 104	UM				
ILLIN	G AGENCY LAYNE ENVIRONMENTAL DRILLER D.W.	LERNER		DATE	FMI	RTED SHED	•		z/91	- 6/12/91		
	G EQUIPMENT CME-75			COMI	PLETI	OH	EPT	<u>ئ</u> ا	58'	SAMPLER		
ILLIN		8'		SA	IO. D	F S	DIST			UNDIST.		
E AN	AND TYPE OF CASING / 11 Scholas PVC			WATER FIRST						COMPL 24 HRS.		
PE OF	PERFORATION FACTORY SLOTS . 020" FROM 56	10 55	FT.	LOG(GED	by MER) 			CHECKED BY		
ZE AN	10 TYPE OF PACK 20-40 Silica SAND PRUM 58	10 <u>53</u>	FT.	77.	PY . /	· (E.K	30					
PE O	F SEAL BENTONITE CHIPS FROM 53	10 /	FT									
		GRAPH			2.	\$	_	_	LES	REMARKS		
663	DESCRIPTION	Lithology	Piezo: Instali	noter letion	¥ &	Plezon Date	Type No	Record	Penetra Resist (Bibyra) 6 in)	(Drill Rate, Fluid toss, Odor, e		
丰	2" Grovel (R.R. Ballast)	PYYO				1 1	-					
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Ŧ	F=119) 348 42 323 KM	/ · ·				-	-					
Ŧ	Moist Poorly Graded	1				-	-					
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+	TR Clay 42%?	l .' ·				-	-					
Ŧ	LT Yellow BEN					-	-			·		
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Woodward-Clyde Consultants PROJECT NAME RMA COE MOTOR TOOL VES HOLE NO. VESP-6 C

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DESCRIPTION	Lithology	Pleasmeter tretoliotion	Wote Conte	Ple rome fer Dafe	Type Ma	Aecor, fi Panetre Penist Blown	(Drill Rate, Fluid loss, Odor, et
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PROJECT NO. 89 M 114-G1

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SHEET 2 OF 7

Woodward-Clyde Consultants PROJECT NAME RMACOE MOTOR POLYES HOLE NO. VESP-6C

		GRAPH	C roe	.=	<u>.</u>	- 5/	MP =1	LES	BEHLEY'S
(FEET)	· DESCRIPTION	Lithology	Plezometer tretoliotion	Wate Conte	Pie rom O ofe	ype Mo	, co.	Resist Bloss 6 h)	REMARKS (Drill Rele, Fluid loss, Odor, etc.)
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7	F-Mg , 506 x-506 Rad	• •]				
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7-	- Moist, Poor Graded	. • •		l		Ė	П		
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	ECT NO. <u>89 M 114 G 1</u> (9948)								SHEET 3 OF.

Woodward-Clyde Consultants PROJECT NAME RMACOE MOTOR POLL VES HOLE NOVESP-6C

	War de Cifus Constituents Tripocon inami	GRAPH	ic Log		:	\$4	MP	LES	
DEPTH (FEET)	DESCRIPTION	Lithology	Plazometer installetion	Water	Piezomet Dafe	Type No.	Recor. ft	Panete Bloss in a	REMARICS (Drill Role, Fluid loss, Odor,etc)
25-	Grovely Sond AS Above Grovel 10% ±		·						
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31	Grovel Size inch to								
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PROJECT NO. 89M 1146-1

(9948)

SHEET 4 OF 7

Woodward-Clyde Consultants PROJECT NAME RMA COE MOTOR POOL VES HOLE NO. VESP- 6

		GRAPHI	c LOG	. =	3	54	-	LES	
OEPTH (FEET)	DESCRIPTION	Lithology	C LOG Pleasmeter Installation	Wote. Conte	Piezome Doda	Type Na	Recor. 1	Penalte Resist Blove 6 h)	REMARKS (Drill Rule, Fluid loss, Odor, etc)
36- 36-	SAND Clayey								
39 - 1 40 42	Eloyey Sondy, Clay & For SLT. Shi plastic, Sand Fg, TR growel 1/8" (CL/ML)								
43- 44-	CT NO. BOM114G1 (9948								SHEET 5 OF 7

Woodward-Clyde Consultants PROJECT NAME RMACOE MOTOR POOL VES HOLE NO. ESP-6C

		GRAPH	ငယ	.=	10.			LES	BC414 BVC
(reer)	DESCRIPTION	Lithology	C LOG Plezometer metalistion	Wate. Conter	Piezom. Dofe	Type No.	Aecor.	Bart Book For a t	REMARKS [Drill Rule, Fluid loss, Odor, etc.]
4	As Above up for 1"grovel, Roded É 1/8" for. 1. Clay Content decr. TE DE 64-18-18 SH Cby Bails Moist (SP)					<u>, , , , , , , , , , , , , , , , , , , </u>			
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50-	SAND F-Cg Sub4-Sublad					 			
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Woodward-Clyde Consultants PROJECT NAME PLACOF MOTOR POLL VES HOLE NO. VESP-GC

		GRAPH	c roe	. =	<u>}</u>	54	MP	LES	
(FEET)	DESCRIPTION	Lithology	C LOG Plazometer Inetaliation	Wete	Pietome Date	Type Na	Recor. 1	Panette Regist 6 in)	REMARKS (Drill Male, Fluid loss, Odor, etc.
3	SAND, Cloyey	· · /			-				
* *	SAND, Clayey LI Vellow BRW F-Cg Sub 4-Sub Rnd Moist. Poor Graded				1 1				·
3	(SP)								
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BORING L	eard-Clyde Consultants 6			15	LEVAT	ЮМ	ANC	DAT	UM		•	
RILLING 4		DRILLERD .	VERVE	12 D	DATE STARTED 6/12/91 - 6/12/91							
DRILLING E	QUIPMENT CME 75			C	/5							
DRILLING !	METHOD Skillow Stem auger	DRILL BIT	3"		NO. SAMP	LES	5	DIST			UNDIST.	
SIZE AND	TYPE OF CASING /" School 40 F	PVC			WAT	ER V.		FIRS	л		COMPL. 24 HRS.	
TYPE OF P	ERECRATION I" PUC Factory Slots	FROM /3	10 /2		OGGE!	GGED BY I.W. MERRELL			EL	4	CHECKED BY	
SIZE AND	TYPE OF PACK 20/40 Silicis Sen	d FROM · 15		-	, ,							
TYPE OF S	SEAL Bentonite Chips	FROM 10	πο /	FT								
DEPTH FEET)	DESCRIPTION		Lithology	Piezome sustalieli	nter 3		Plezometer Dote	Type He	Ascor AL	See of Care	REMARKS (Drill Rote, Fluid loss, Oder, etc.	
	IN BLE SOIL		25			7			Π			
= = = = = = = = = = = = = = = = = = = =	SAND, CKYCY,						-	11				
‡	LT Yellow BeN		' /				1					
/ 	Munsen 104R 4/2	7	/ , ,				1					
#	F-Mgr, Sub4-S Moist, Party Gn	46 Ena	, ,				11.					
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	Fines 25%											
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Woodward-Clyde Consultants PROJECT NAME RMACOE MOTOR POULVES HOLE NO. VESP-7A

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(re er.)	DESCRIPTION	Lithology	Plezometer Inetal lation	Wete Conte	Pie rom Date	Type Ho	Recor.	Reserve	REMARKS (Drill Rate, Fluid loss, Odor, etc)
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1	SAND LIT Yellow BEN F-Mg SUBA-JUS END POORGENTED - Moist				1 1	-			
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PROJE	ct no. <u>89M114G1</u>	(99	(48)						SHEET 2 OF 2

RING LO	ard-Clyde Consultants 6				222	ZV.		DAT	UM			
ILLING M		DRILLERD, L	Verra		DATE	EMI	EHFD	6		1/9	SAMPLER	6/11/93
HILLING EQ	WIPMENT CHE-75				cour						UNDIST.	
RILLING M	ETHOO Hollow Stem Auga	DRILL BIT	<u> 5" </u>			O. DI		DIST.			COMPL.	24 HRS.
ZE AND	TYPE OF CASING /11 PUC Scho	40				LEV.		FIRS	• 1			<u>i</u>
PE OF PE	REPORATION Factory 5/015-02	SFROM 46	10 <i>45</i>	FT.		ED	er !rre	- //			CHECKED	3 1
ZE AND	TYPE OF PACK AD-40 Silect	FROM 48	10 43	FT.	7.	1- 16	rre	2//				
PE OF SI	ear Bentonite Chips	FROM 43	103e	FT								
	Contract Person		GRAPH	ic L	×	.=	\$	92	MPL	ES		
4 (CT)	DESCRIPTION		Lithology		restor lation	S s	Plezon Dete	ž X	Ş.		(Drill Ret	REMARKS a, Fluid loss, Odor, etc.
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Ŧ~	Sano, Clayer,				1			-	11			
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PROJECT NO. WCC 89M11461 (9948)

SHEET___OF_6

Woodward-Clyde Consultants PROJECT NAME RAY COE Motor Pol VES HOLE NO. VESP-78

	ward-clyde Conscitation (1715)	GRAPH	ic roe	. =	<u> </u>	\$4	MP	LES	
OEPTH (FEET)	DESCRIPTION	Lithology	Piezometer Installation	Water	Piezome Dofe	Type No.	Aecor.	Period Blows 6 in)	REMARKS (Drill Role, Fluid loss, Odor, etc)
7	As San		·		1				
8	(SP)								
9					1,,,,,,				
7 +		- ,							
10	SOUD LT-Yellow BED F-Mg Subx-Sub RA				1 1 1 1	- - - - -			
// 	Fires decr	• 1							
1	Fines decr								
/2	(SP)	- ',							
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16	- - - -					‡			

PROJECT NO. W.C 89M11461

(9948)

SHEET 2 OF 6

Woodward-Clyde Consultants PROJECT NAME RUA Motoe Red VES HOLE NO. VESP-7B

	odward-Cryde Constitution - 1100201 1144111	GRAPH	IC LOG		1		MP	LES	
HE & DO	DESCRIPTION	Lithology	Pigameter trictol lot los	Water Conten	Piezomei Dofe	Type Ma	Aecor, (1	2000 000 st t t t	REMARICS (Dritt Rate, Fluid loss, Odor, etc)
10		, ,			7	-			
ľ	SULT IT WOULD BOD								
	+ Japas L. Yellow Deed	•			1 1	-			
ı	IM-Ca, Subx-ShAI					•			
17	+ 1 2 3 3 4 7 5 6 7 6 7 6 7 6 7 6 7 6 7 6 7 6 7 6 7	12.]]	1			
1	I Most Poor Soul				1				·
	SOND LT YELLOW BED M-Cg, Sub K, Sub End Moist Poor Soul. Teace Grit 19-14" (1-2%) TR Fine's				13				
1.	100ce Conit 19-14	, .			<u> </u>				
1/8	5 † (/-2%-)					-	П		
	TR Fine's				3				
1	F SP)					Ė			
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C	COMULACI		 						7 /

Woodward-Chyde Consultants PROJECT NAME PAR Mothe Ros VES HOLE NO. VESP-78

T		GRAPH			<u>}</u>	SA	UPLE	3	0.544.045
(reen	DESCRIPTION	Lithology	Plesometer Installation	Wete. Conte	Piezome Dofe	Type No	Penetre.	8 00 0 F 00 00	REMARKS (Drill Rate, Fluid loss, Odor, etc
25-	SAND LTYELLW BEN M-Cg, SubEnd Moist		·		4	-			
مريز	M-Cg, Subtend Moist Some Grit 18-14" 10% Subtend	- ,			1	-			
7	Sub Ral	,							
27	(SP)					_			
	-	5 / • /							·
9					1 1 1 1 1 1 1 1	والموروا			
30-	As above								
3/-	Coverel incr to 15% 2 18"-12" Moist Paux Sout	0							
2	(Sp)	. 6				+ + + + + + + + + + + + + + + + + + +			
33 -	T ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' '	.,			-	† ,			
34.	<u> </u>	0'				† † † † † †			

PROJECT NO. 89M11461

(9948)

SHEET 4 OF 6

Woodward-Clyde Consultants PROJECT NAME PHA MOTOR FOOL VES HOLE NO

		ward-Cryde Constitution - Project Hamilton	69494	IC 100		_	54	MP	FS	
	(FEET)	DESCRIPTION	GRAPH Lithology	Pleasureter anetolistics	Weter Content	Piezomete Dote	ğ	-1	# # F F F F F F F F F F F F F F F F F F	REMARKS (Drill Role, Fluid loss, Odor, etc)
3	4	SAND, LT Yellow BED POUR BRADED Mois! H-Cg, Sub 4 - Sub End. 20% Fine Ground & Grit								
3	۷-	- - - - -								
3	37									
	E-									
3	<i>y</i> -									
4	H	SAND, Cloudy F-Mg Subx Moist, Poor Gradul	.,							
4	41 - -	Moist, Poor Gradel				-	+++++			
	42: 43:	(SP)					+ + + + + + + + + + + + + + + + + + + +			

PROJECT NO. 89M11461

(9948)

SHEET 5 OF 6

Woodward-Clyde Consultants PROJECT NAME RIA MOTOR FOLL VES HOLE NO. VESP-78

		GRAPH		. =	<u>}</u>	SA	MPLES	
(reer)	DESCRIPTION	Lithology	Plezometer petaliction	Water	Pietome Dofe	Type B	Person f	REMARKS (Drill Rete, Fluid loss, Odor, etc)
43	As Abar	. /			+	-		
44	(sr)	\\ \\ \\ \\						
45	SAND & CLAY LTYELLOW BEN F-Mg							
46	Low Plastic, Plais 4							
77	CL/SP		,					
48	7.0			,		مملميمام		
					4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4			

	-				-	‡		

PROJECT NO. 89/11461

(9948)

SHEET 6 OF 6

Woodward-Clyde Consultants PROJECT NAME RMA COE Mata-Pool 3 HOLE NO. UESP-7C BORING LOCATION SEC 4 DRILLING AGENCY LAYRE Environmental WERNER UNDIST. DRILL BIT DRILLING METHOD HOLLOW Stem auga 24 HRS. COMPL. CHECKED BY FROM 56 PC School 40. HW.MERRELL Bantonite Chips DEPTH FEET) REMARKS
E SO W (Drill Rete, Fluid tose, Odor, etc.) DESCRIPTION Ckyey Sand, LI Yellow Ben 1 = (Munsell) 104R 4/4 F-Mg, Sub 4-Sc5Res Mast, non-plastic Poorly Graded, moist.

PROJECT NO. LOC - 89M114-G1

(9948)

SHEET 1 OF 7

(FEET)	DESCRIPTION	Litho	RAPHIC LOG logy Plezomete inetaliatio	Water Content Plezonete Dote	Type No. Recor. ft Penetra.	P c l	MARKS Fluid loss, Odor, etc)
-	Clayer Sand 1	Is About /		1			
3 +		5P .					
+		,					
‡ † †				-			
+	SAND, SLIC LT Yellow BAN	1	,				
' Ŧ	F-C g (few) 543 & - 5.6 and				 		
2 + '	Clay & Freis Redui						
‡ ‡ 3 ‡	Poorly Graded, n	10以 (夏) (SP) (1	,				
† + + + +					-		
4					Ŧ		
15-1		,			1		
6 +			/.		‡		

Woodward-Clyde Consultants PROJECT NAME Have Pool	VES HOLE NO. VESP-7C
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		GRAPHI	င်ယ		3		-	LES	
OEPTH (FEET)	DESCRIPTION	Lithology	Plesometer tretel let les	Woter	Piezome Date	Type Ma	Recor. ft	2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	REMARKS (Drill Rule, Fluid loss, Odor, etc)
16	SOUP AS BLOWE	,/ 	,		1000				
17	Sc/sp	- , . ,			1	1			·
18		.,							
J9 -					1				
20	SAND LTYEllow BEN Munscoll) 104E 4/4								
21 -	SAND LTYEllow BEN [Munsell) 104E 4/4 F-C g 5% Fine Good (Grit) 18-14"	() ()							
22-	Moist Poor Graded	1 ,				† 			
23					-	-			
24						T			
25-						‡ <u>+</u>			

PROJECT NO. WILL BAM 1461

(9948)

SHEET 3 OF 7

Woodward-Clyde Consultants PROJECT NAME Motor Pool VES HOLE NO. VESP-7C

		GRAPH	C LOG		x	54	MP	LES .	
0EPTH (FEET)	DESCRIPTION	Lithology	Pleasmeter Installetter	Woter	Pieromet Date	Type Ma	Ξ		REMARKS (Drill Rule, Fluid loss, Odor,etc)
25-	Sand AS ABOO.	, ,			4	- : :			
	<u> </u>	<i>c</i> ' '	·			- :			
26-		, , .			-	-			
1 1	(SP)		·		1				
27-	· -				1000	-			
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28-		- ,			1				
1 1 1	- - -	· ,			1111	1			
29-	_	` '							
1 1 1					1111				
30		, ,							
	SAND, Cleyey Lt yellow Ben	/,							
31 -	Lt Yellow Ben	` ' >							
	Morst, Pour Gradel	'.				-			
32-	FMg., TR Grit Size	, ,				-			
	(SP)	/.				F.			
<i>33</i> -					-	+			
		(/				 			
34-	**************************************	948)			_	E_			SHEET 4_ OF 7
PROJE	ECT NO. 89M11461 (9	110)							SHEET TOP I

	GWard-Ciyde Consultants PROJECT MAME	GRAPH	C LOG	. =	3	54	M	LES.	
OE PIN	DESCRIPTION	Lithology	Piezometer Inetal lation	Water	Pie rome Oate	Type Na	Secor.	Penetra Regist Blove 6 In)	REMARKS (Drill Role, Fluid loss, Odor, etc)
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36.	< / // // // // // // // // // // // //	٠ ,							
	SIND, Sci Cleyey	, .			1	•			
	LTYELLOW BRN,	- '			1	_			
36.	Hon Nostic Moist	/			-				
	Non Nostic, Moist	()				-			
	Lit Grit Sized growni					1			
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	Sand LTYPHOW BUN	-]	_			
	M-Cg, Suy 4-Sub Rad, Mort								
42	† ξ	<u> </u> -			-	+			
	Clay, Plastic, moist					‡			
	Eco 1048 4/4	· .				‡			
43	+	_			-	<u>E</u>			

Woodward-Clyde Consultants PROJECT NAME RYA COE Moto-Pod VES HOLE NO. VEST-7C

		GRAPH	ic roe	- 5	}	-	Ξ	PLES	BEULDM
(FEET)	DESCRIPTION	Lithology	C LOG Plazometer metalicition	Wete Conte	Piezome Dofo	Type No.	Recor. 1	Paret Period Biose F	REMARKS (Drill Rule, Fluid loss, Odor, e
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6+	CLAY SOST, SLi PlostEc, moist; Some	1//.]				
Ŧ	Plaster, moist; Some]				
Ŧ						-	ĺ		
_ ‡	Sand & SLT - 30%		1]	_	ı	}	
47 🕇	(CL)					-		1	
<u>‡</u>	(CL)]]			1	
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52		9948	<u> </u>			土			SHEET 6 OF

PROJECT NO. 89/4/1461

(994B)

SHEET 6 OF Z

Woodward-Clyde Consultants PROJECT NAME RHA COE Motor Pool VES HOLE NO. VESP-7C

		GRAPH	C LOG	. =	<u> </u>	54	MPL	.ES	
0EPTH (FEET)	DESCRIPTION	Lithology	Plezometer tratellation	Wote Conter	Pierome Date	Type No	Aecor.	70 00 00 00 00 00 00 00 00 00 00 00 00 0	REMARKS (Drill Rule, Fluid loss, Odor, etc
52	SAND LT Vellow BROWN Munsell 104R 4/4 F-M-grained, Subst, Sub Run Moist, Poor Gradeb TR Sines				1				
<i>A</i>	(SP)								
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53	7.D 								
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PROJECT NO. 89/11461

(9948)

SHEET ZOFZ

APPENDIX B ANALYTICAL CHEMISTRY RESULTS



Form ARF-AL

DALA								Part	1	or of	1
' CH	$\mathbf{E}\mathbf{M}$			ł					-		
LABORA	TORIES				Date		7/29/9	,			
					Agency	Identii	ication N	imher 91	_105	Q	_
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								- i	Managem 2.7 LG	-	
Voodward-Cl 4582 South Standford P Denver, CO Attention:				Telej	PAX _	103)	740-	2791			
6		1> 1						ı			
Sampling Col			-								
8	ampling S	ite		-		Date of	Collectio	n July	16,	1991	
D	ate Sampl	es Rec	eived a	t Dat	Chem _lul	ly 22, 1	991				
Analysis											
=	ethod of	Analys	is GC/F	ID							
					1001			-			
	ate(s) of	кпату	ara TIIT	7.24.	1991			 			+
Analytical B	Results		·								
Private and the second			rifchloro sthylene sq/sample A' SECTION	richloro thylene 44/sample							
VESP5A071691 CL	14995	CT	0.06	ND*				 		 	-++-
VESP58071691 CL	14996	CT	0.14	ND*						<u> </u>	
VESP5C071691 CL		CT	0.16	ND*							
VESP68071691 CL		CI CI	0.13	ND*							
VESP6C071691 CL		CT	0.17	ND*						 	
VESP7A071691 CL		CT	0.23	ND*	 					├	
VESP7B071691 CL		CT	0.21	MD*						 	
VESP7C071691 CL	15003	CŦ	0.17	ND*						 	╫
VESP8A071691 CL		CT.	0.09	MD*						<u> </u>	$\dashv \vdash$
/ESP8B071691 CL		CT	0.09	ND*							
/ES-1000-P CL		CT CT	0.02	MD.				_			
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960 West LeVoy Drive / Salt Lake City, Utah 84123-2547 / (801) 266-7700 A Sorenson Company



Form ARF-BL

Page 2 of

Part 1 of

Date 7/29/91
Agency Identification Number 91-1959

Analytical Results

Analytical	VESGIIS								1	
rield Field Stable Wabber			Trichloro ethylene mg/sample 'A' section	Trichloro ethylene mg/sample 'B' SECTION						
VES-1001	CL 15008	CT	ND*	ND.				T		Т
VESP5A071791	CL 15009	CI	0.22	ND.						Т
VESP58071791	CL 15010	CT.	0.06	MD.				1		T
VESP5C071791	CL 15011	CT	ND4	ND*						T
VESP6A071791	CL 15012	CI	0.11	MD.						Т
VESP6B071791	CL 15013	CI I	0.06	MD*						I
VERP6C071791	CL 15014	CI	ND*	#D*				\prod		I
UESP7A071791	CL 15015	CI	0.07	ND.						\mathbf{I}
VESP7B071791	CL 15016	C T	0.10	MD.						
VESP7C071791	CL 15017	CT	ND*	ND*						
VESP8A071791	CL 15018	CT	0.02	ND*						T
VESP89071791	CL 15019	CT	0.02	יםא				T		T
VESP8C071791	CL 15020	ст	0.01	ND.						
VES-3-071791	CL 15021	CI	0.25	ND*						
VBSDIS071791	CL 15022	CT	ND+	ND*					_	
VES-1002-P	CL 15023	CT	0.26	ND*						
VES-1003	CL 15024	CŤ	ND+	ND*						
VESP5A071991	CL 15025	CT	0.05	ND4						П
VESP58071991	CL 15026	CT	0.19	ND*						
VESP5C071991	CL 15027	CT	0.22	ND*						Π_
VESP6A071991	CL 15028	CŦ	0.06	ND*				T		
VESP6B071991	CL 15029	CT	0.19	ND*						
VESP6C071991	CL 15030	C7	0.25	ND*				T		
VESP7A071991	CL 15031	CT	ND,	ND.	\prod			\top		1
VESP78071991	CL 15032	CT T	0.23	ND*	\prod					
VESP7C071991	CL 15033	CT	0.24	MD.	\prod			7		\parallel
VESP8A071991	CL 15034	CI	ND*	ND*				1		
VESP88071991	CL 15035	CT	0.11	MD.				\top	 ***	T
VESP8C071991	CL 15036	CT	0.11	ND+	\prod			1		T
VESDES071991		CT	ND*	ND.	\prod			1		T
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NR Parameter not requested.

^{**} See comment on last page.

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Form ARF-BL

Page 3 of Part 1 of

Date 7/29/91
Agency Identification Number 91-1959

Analytical Results

Analytical	l Results									
Just Suply Suply	Manual Control of the		Trichloro ethylene eg/sample 'A' SECTION	Trichloro ethylene mg/sample 'B' SECTION						
VES-3-071991	CL 15038	CT	0.16	MD*						Т
VES-1004-P	CL 15039	CT	0.15	HD.						十
VES-1005	CL 15040	CT	ND*	ND*						
TRIP BLANK	CL 15041	CT.	ND.	ND*						
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AUG 1 2 1991

Form ARF-AL

1 of 2 Page Part 1 of

VICC/DENVER, COLORADO

Date	9/9/91	
	Identification Number 91-2024	
_	No. 03019	

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Standford Place 3, Suite 1000 Denver, CO 80237 Attention: Jeff Cox

FAX		
Telephone	(303)	740-2791

Sampling	Collection and Shipment Sampling Site Date of Collection July 24, 1991
	Sampling Site Date of Collection July 24, 1991
	Date Samples Received at DataChem <u>July 26, 1991</u>
Analysis	
•	Method of Analysis NIOSH 1022
	Date(s) of Analysis July 31, 1991

Analytical	Results			T	T			<u> </u>	1
Field Sample Rumber	DataChem Lab Number	Sample Type	Trichloro ethylene MG/SAMPLE A SECTION	Trichloro ethylene MG/SAMPLE B SECTION					
VES5A072491F	CL 15626	CT	0.01	ND*	L			 	-
VES5B072491F		CT	0.03	ND*				 -	┨ -
VES5C072491F	CL 15628	CT	0.07	ND*			 		-
VES6A072491E	CL 15629	CT	0.03	ND*		·			┨—
VES6B072491F	CL 15630	CT	0.07	ND*				 	ł
VES6C072491	CL 15631	CT	0.19	ND*			 	 	-
VES7A0724911	CL 15632	CT	ND*	ND.			 	 -	
VES7B0724911	CL 15633	CT	0.14	ND*				 	
VE57C0724911	CL 15634	CT	0.08	ND*					┨
VES8A0724911	PCL 15635	CT	ND*	ND*				 	-
VES8B0724911	PCL 15636	CT	0.04	ND*				 <u> </u>	
VES8C0724911	PCL 15637	CT	ND*	ND*				 -	-
VES3072491P	CL 15638	CT	0.10	ND*					_ـــــــــــــــــــــــــــــــــــــ

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Form ARF-BL

Page Part of

2

1 of

2

Date 9/9/60Agency Identification Number 91-2024

				1		İ					
Field Sample Sumber	DataChem Leb Number	Sample Type	Trichloro ethylene MG/SAMPLE A SECTION	Trichloro ethylene MG/SAMPLE B SECTION							
ESDIS072491	CL 15639	СТ	ND*	ND*							
ES-1006-P	CL 15640	CT	0.08	ND*							
ES-1007	CL 15641	CT	ND*	ND*		·					
	CL 15642	CT	ND*	ND*							ŀ
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ANALONICAL REPORT

AUG 2 8 1991

Form ARFLAL

Page 1 of 4 Part 1 of 1

WCC/DENVER, COLORADO

Date	8/23/91	
Agency	Identification Number 91-2162	
•	No. 03019	

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Standford Place 3, Suite 1000 Denver, CO 80237 Attention: Jeff Cox

FAX		
Telephone	(303)	740-2791

Sampling	Collection and Shipment Sampling Site Date of Collection July 29, 1991	
	Sampling Site Date of Collection July 29, 1991	
	Date Samples Received at DataChem <u>August 06, 1991</u>	_
Analysis		
	Method of Analysis NIOSH 1003, NIOSH 1007, NIOSH 1022	
	Date(s) of Analysis August 15, 1991	_

Analytical Results

Field Sample Number	DataChen Lab Number	Sample Type	Trichloro ethylene mg/sample GC/FID	1,2-Dichloro ethene mg/sample GC/FID	vinyl Chloride mg/sample GC/FID	
5A-072991-P	CL 17099	CT	ND*	ND*	ND*	
5B-072991-P	CL 17100	CT	0.02	ND*	ND*	Wed
5C-072991-P	CL 17101	CT	ND*	ND*	ND*	L WUND COG
6A-072991-P	CL 17102	CT	0.01	ND*	ND*	1
6B-072991-P	CL 17103	CT	0.03	ND*	ND*	
6C-072991-P	CL 17104	CT	0.02	ND*	ND*	
7A-072991-P	CL 17105	CT	ND*	ND*	ND*	
7B-072991-P	CL 17106	CT	0.03	ND*	ND*	
7C-072991-P	CL 17107	CT	0.02	ND*	ND*	
8A-072991-P	CL 17108	CT	ND*	ND*	ND*	1 to 19 than code
8B-072991-P	CL 17109	CT	0.03	ND*	ND*	
8C-072991-P	CL 17110	CT	ND*	ND*	ND*	
DIS-072991-1	CL 17111	CT	ND*	ND*	ND*	

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Analyst: Jeff R. Scott

Reviewer: Fred M. Rejali



Form ARF-BL

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of 1 Part 1

Date	3/23/01	
	Identification Number 91-2162	

Analytical Results

Field Sample Number	DataChem				•					ŧ
	tab Wumber	Staple Type	Trichloro ethylene mg/sample GC/FID	1,2-Dichloro ethene mg/sample GC/FID	Vinyl Chloride mg/sample GC/FID					
VES4072991-P	CL 17112	CT	0.17	ND*	ND*	 				
VES-2000-P	CL 17113	CT	ND*	ND*	ND*	 	<u> </u>			\sqcup
VES-2001	CL 17114	CT	ND*	ND*	ND*					
5A-073191-P	CL 17115	CT	ND*	ND*	ND*					
5B-073191-P	CL 17116	CT	0.01	.ND*	ND*					_
5C-073191-P	CL 17117	CT	0.04	ND*	ND*					Ш
6A-073191-P	CL 17118	CT	ND*	ND*	ND*	 				
6B-073191-P	CL 17119	CI	0.02	ND*	ND*					
6C-073191-P	CL 17120	CT	ND*	ND*	ND*	 				<u> </u>
7A-073191-P	CL 17121	CT	ND*	ND*	ND*					
073191-P	CL 17122	CT	ND*	ND*	ND*	 				<u> </u>
7C-073191-P	CL 17123	CT	0.03	ND*	ND*	 				ļ
8A-073191-P	CL 17124	СТ	ND*	ND*	ND*			<u> </u>	<u> </u>	<u> </u>
8B-073191-P	CL 17125	CT	0.03	ND*	ND*					<u> </u>
8C-073191-P	CL 17126	CT	0.03	ND*	ND*	 				
DIS-073191-P	CL 17127	CT	ND*	ND*	ND*	 			ļ	<u> </u>
VES4073191-P	CL 17128	СТ	0.19	ND*	ND*	 			ļ	▙
VES-2002-P	CL 17129	СТ	0.03	ND*	ND*			_		ļ
VES-2003	CL 17130	СТ	ND*	ND*	ND*			ļ		₋
5A-080291-P	CL 17131	CT	ND*	ND*	ND*					<u> </u>
5B-080291-P	CL 17132	CT	ND*	ND*	ND*			ļ		↓_
5C-080291-P	CL 17133	СТ	0.01	ND*	ND*					<u> </u>
6A-080291-P	CL 17134	CT	ND*	ND*	ND*					<u> </u>
6B-080291-P	CL 17135	CT	0.02	ND*	ND*					†
6C-080291-P	CL 17136	CT	0.02	ND*	ND*		ļ	ļ		1_
7A-080291-P	CL 17137	CT	ND*	ND*	ND*	 ļ	ļ		 	
7B-080291-P	CL 17138	CT	ND*	ND*	ND*				<u> </u>	1_
7C-080291-P	CL 17139	СТ	0.02	ND*	ND*					1_
8A-080291-P	CL 17140	СТ	ND*	ND*	ND*				ļ	\perp
8B-080291-P		ст	0.03	ND*	ND*				<u> </u>	

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Date	8/73/91	
	Identification Number 91-2162	

Analytical Results

Analytical	Results						 			
rield Sample Wumber	DataChem Lab Number	Sample Type	Trichloro ethylene mg/sample GC/FID	1,2-Dichloro ethene mg/sample GC/FID	Vinyl Chloride mg/sample GC/FID					
8C-080291-P	CL 17142	CT	ND*	ND*	ND*					
VES-2004-P	CL 17143	CT	0.02	ND*	ND*		 			_
VES4080291-P	CL 17144	CT	0.13	ND*	ND*					
DIS-080291-P	CL 17145	CT	ND*	ND*	ND*					
VES-2005	CL 17146	CT	ND*	ND*	ND*					_
TRIP BLANK	CL 17147	CI	ND*	ND*	ND*	10.002000000000000000000000000000000000				
" Limit of D	etection		0.01	0.51	0.001					
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Date	8/23/91
	Identification Number 91-2162

Sample Comments

DataChem Lab Number

-- Comment --

CL 17135

B-SECTION CONTAINED >30% OF REPORTED AMOUNT OF TRICHLOROETHYLENE.



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Form ARF-AL

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AUG 2 8 1991

WCC/DENVER, COLORADO

Date	8/23/91	
Agency I	dentification Number 91-2217	
_	No. 03019	

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Stanford Place 3, Suite 1000 Denver, CO 80237 Attention: Rich Scheig

FAX Telephone (303) 694-2770

Sampling (Collection and Shipment Sampling Sita Date of Collection August 07, 1991
	Date Samples Received at DataChem August 09, 1991
Analysis	Method of Analysis NIOSH 1003, NIOSH 1007, NIOSH 1022
	Date(s) of Analysis August 16, 1991

Analytical Results

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Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene mg/sample GC/FID	1, 2-Dichloro ethene mg/sample GC/FID	Vinyl Chloride mg/sample GC/FID					
VES5A080791P	CL 17746	CT	ND*	ND*	ND*					1
VES5B080791P	CL 17747	CT	ND*	ND*	ND*					<u> </u>
VES5C080791P	CL 17748	CT	0.01	ND*	ND*					_
VES6A080791P	CL 17749	CT	ND*	ND*	ND*]
VES6B080791P	CL 17750	CT	0.02	ND*	ND*	<u> </u>				1_
VES6C080791P	CL 17751	СТ	0.02	ND*	ND*			<u> </u>	<u> </u>	
VES7A080791P	CL 17752	CT	ND*	ND*	ND*				<u> </u>]_
VES7B080791P	CL 17753	CT	ND*	ND*	ND*		<u> </u>			4_!
VES7C080791P	CL 17754	CT	0.02	ND*	ND*	<u></u>				
VES8A080791P	CL 17755	CT	ND*	ND*	ND*				<u> </u>	
VES8B080791F	CL 17756	CT	0.04	ND*	ND*					ļ!
VES8C080791F	CL 17757	СТ	0.11	ND*	ND*					_
VES4080791-F	CL 17758	CT	0.08	ND*	ND*					丄

* See comment on last page. ND Parameter not detected. NR Parameter not requested. ** See comment on last page.
() Parameter between LOD and LOQ.

Analyst: Jeff R. Scott

Reviewer: Fred M. Rejali



Form ARF-BL

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of Part 1

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Date _		
Agency	Identification Number 91-2217	

Analytical	Results										I
Field Sample Number	DetaChem Lab Number	Sample Type	Trichloro ethylene mg/sample GC/FID	1,2-Dichloro ethene mg/sample GC/FID	Vinyl Chloride mg/sample GC/FID						
VESDIS080791	CL 17759	CT	ND*	ND*	ND*						
VES-2006-P	CL 17760	CT	ND*	ND*	ND*						-
VES-2007-P	CL 17761	CT	ND*	ND*	ND*						\vdash
TRIP BLANK	CL 17762	CT	ND*	ND*	ND*						H
* Limit of D	etection		0,01	0.01	0,001						
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Agency Identification Number 91

Account No. 03019

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Stanford Place 3, Suite 1000 Denver, CO 80237 Attention: Rich Scheig

Telephone (303) 694-2770

Sampling	Sampling Site Date of Collection August 12, 1991	
	Date Samples Received at DataChem <u>August 14, 1991</u>	
Analysis	Method of Analysis NIOSH 1003, NIOSH 1007, NIOSH 1022	
	Date(s) of Analysis August 26, 1991	_

Analytical Results

Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene mg/sample GC/FID	1,2-Dichloro ethylene mg/sample GC/FID	Vinyl Chloride mg/sample GC/FID				
VES5A081291P	CL 18144	CT	ND*	ND*	ND*				╀
VE55B081291P		СТ	ND*	ND*	ND*			 	┼
VES5C081291P		CT	0.04	ND*	ND*		 		╀
VES6A081291P		СТ	ND*	ND*	ND*		 	 	┼
VES6B081291P		CT	ND*	ND*	ND*			 	┼
VES6C081291P		CT	ND*	ND*	ND*				┼-
VES7A081291P		CT	ND*	ND*	ND*				╀
VES7B081291P		CT	ND*	ND*	ND*				╄
VES7C081291P		CT	ND*	ND*	ND*				╀-
VES8A081291P		CT	ND*	ND*	ND*				1
VES8B081291P		CT	ND*	ND*	ND*	<u> </u>	<u> </u>	 ·	╀-
VES8C081291F		CT	0.03	ND*	ND*		 	 	+
DIS-081291-F		CT	ND*	ND*	י סז:				丄

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Form ARF-BL

Page 2 of 2 Part 1 of 1

Date ______ 8/30/90Agency Identification Number 91-2499

Analytical	Results										
Field	DataChem Lab Number	Sample Type	ro e le	1,2-Dichloro ethylene mg/sample GC/FID	Vinyl Chloride mg/sample GC/FID						
Sample Number		lype	hlo len amp ID	Dic len amp	1 amp						
			Trichloro ethylene mg/sample GC/FID	1,2- ethy mg/s GC/F	Viny mg/s GC/F						ļ
VES3081291P	CL 18157	CT	0.05	ND*	ND*						_
VES-3000-P	CL 18158	CT	ND*	ND*	ND*						\vdash
VES-3001	CL 18159	СТ	ND*	ND*	ND*						-
TRIP BLANK	CL 18160	СТ	ND*	ND*	ND*					777	
* Limit of E	etection		0.01	0.01	0.001				. 4		<u> </u>
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Form ARF-AL

1 Page of

of 1 Part

Agency Identification Number 91-2630 Account No. 03019

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Stanford Place 3, Suite 1000

Denver, CO 80237

Attention: Rich Scheig

FAX		
Telephone	(303)	694-2770

Sampling	Collection and Shipment Sampling Site Date of Collection August 19, 1991
	Date Samples Received at DataChem <u>August 26, 1991</u>
Analysis	Method of Analysis NIOSH 1003, NIOSH 1007, NIOSH 1022
	Date(s) of Analysis August 30, 1991

Analytical Results

Analytical	Kesuits							 i	1	1
Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene MG/SAMPLE GC/FID	1,2-Dichloro ethylene MG/SAMPLE GC/FID	Vinyl Chloride MG/SAMPLE GC/FID					
5A-081991-P	CL 19351	CT	ND*	ND*	ND*			<u> </u>	ļ	╀
5B-081991-P	CL 19352	CT	0.01	ND*	ND*					╂
5c-081991-P	CL 19353	СТ	ND*	ND*	ND*			 		+-
	CL 19354	CT	ND*	ND*	ND*				-	┼-
6B-081991-P	CL 19355	CT	0.01	ND*	ND*					╀
6C-081991-P	CL 19356	CT	0.04	ND*	ND*					╀
7A-081991-P	CL 19357	CT	ND*	ND*	ND*			 <u> </u>		╁-
7B-081991-F		CT	0.03	ND*	ND*			 		
7C-081991-P		CT	0.03	ND*	ND*				-	+
	 	СT	ND*	ND*	ND*	<u> </u>		 		+
		CT	0.01	ND*	ND*			 _		+
8C-081991-F	+	СТ	0.03	ND*	ND*				-	+
VES3081991F		СТ	0.05	ND*	ND*					丄

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Date	9/5/9	/
	Identification	

Analytical	Results					 				l
Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene MG/SAMPLE GC/FID	1,2-Dichloro ethylene MG/SAMPLE GC/FID	Vinyl Chloride MG/SAMPLE GC/FID				·	
DIS-081991-P	CL 19364	СТ	ND*	ND*	ND*					<u> </u>
VES-3002-P	CL 19365	ст	ND*	ND*	ND*					
VES-3003	CL 19366	СТ	ND*	ND*	ND*					<u> </u>
TRIP BLANK	CL 19367	ст	ND*	ND*	ND*			verse e e e e e e e e e e e e e e e e e e	1	
* Limit of E	etection		0.01	0.01	0.001		in a second			-
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Date _	9/17/0	71	
Agency	Identification		
Accoun	t No. <u>03019</u>		

Date of Collection August 26, 1991

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Stanford Place 3, Suite 1000 Denver, CO 80237 Attention: Rich Scheig

FAX Telephone (303) 694-2770

Sampling	Collection	and	Shipment
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Sampling Site _____

Date Samples Received at DataChem September 03, 1991 Analysis Method of Analysis NIOSH 1003, NIOSH 1007, NIOSH 1022 Date(s) of Analysis September 12, 1991

	Analytical	Results										,
	Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene MG/SAMPLE GC/FID	1,2-Dichloro ethylene MG/SAMPLE GC/FID	Vinyl Chloride NG/SAMPLE GC/FID			·		-	
	VES5A082691P	CL 20127	СТ	ND*	ND*	ND*						L.
	VES5B082691P	CL 20128	CT	0.03	ND*	ND*						<u> </u>
	VES5C082691P	CL 20129	CT	0.01	ND*	ND*						<u> </u>
	VES6A082691P	CL 20130	CT	ND*	ND*	ND*						<u> </u>
•	VES6B082691F	CL 20131	СТ	0.02	ND*	ND*						L
	VES6C082691P	CL 20132	CT	ND*	ND*	ND*						ļ
	VES7A082691P	CL 20133	CT	ND*	ND*	ND*						<u> </u>
	VES7B082691P	CL 20134	CT	0.02	ND*	ND*						1_
	VES7C082691P	CL 20135	CT	ND*	ND*	ND*						
	VES8A082691P	CL 20136	СТ	ND*	ND*	ND*						L
	VES8B082691P	CL 20137	CT	0.02	ND*	ND*			į.		!	L
	VES8C082691P	CL 20138	CT	ND*	ND*	ND*		!				
	VES3082691P	CL 20139	СТ	0.05	ND*	ND+	1					L

See comment on last page. ND Parameter not detected. NR Parameter not requested.

** See comment on last page.
() Parameter between LOD and LOQ.

Analyst: Fred M. Rejali

Reviewer: Jeff R.

Laboratory Supervisor: Daniel J. Bruch

960 West LeVoy Drive / Salt Lake City, Utah 84123-2547 / (801) 266-7700 A Sorenson Company



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Date	9117/91
	Identification Number 91-2715

Analytical Results

	Analytical	Kesults									
	Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene MG/SAMPLE GC/FID	1,2-Dichloro ethylene MG/SAMPLE GC/FID	Vinyl Chloride MG/SAMPLE GC/FID					
	VESDIS082691	CL 20140	CT	ND*	ND*	ND*					L
·	VES-3004-P	CL 20141	СТ	0.02	ND*	ND*			ļ		L
	VES-3005	CL 20142	CT	ND*	ND*	ND*	 				L
	VES5A083091P	CL 20143	CT	ND*	ND*	ND*				ļ	L
	VES5B083091P	CL 20144	CT	0.03	ND*	ND*	 				L
	VES5C083091P	CL 20145	CT	ND*	ND*	ND*					L
	VES6A083091P	CL 20146	СТ	ND*	ND*	ND*					L
	VES6B083091P	CL 20147	СТ	0.02	ND*	ND*					L
	VES6C083091P	CL 20148	CT	0.01	ND*	ND*					L
	VES7A083091P	CL 20149	CT	ND*	ND*	ND*					
١	VES7B083091P	CL 20150	СТ	0.03	ND*	ND*	 				L
	VES7C083091P	CL 20151	СТ	0.03	ND*	ND*					<u>L</u> .
	VES8A083091F	CL 20152	СТ	ND*	ND*	ND*					L
	VES8B083091P	CL 20153	CT	0.01	ND*	ND*		_			L
	VES8C083091P	CL 20154	СТ	0.02	ND*	ND*			<u> </u>		<u> </u>
	VES-4000-P	CL 20155	СТ	0.03	ND*	ND*					
	VES-4001	CL 20156	CT	ND*	ND*	ND*					_
	TRIP BLANK	CL 20157	CT	ND*	ND*	ND*					<u> </u>
	* Limit of D	etection		0.01	0.01	0.001					L
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NR Parameter not requested.

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Date		9/17/0	71	
			ber <u>91–2776</u>	
Account	No. 0301	19		

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Stanford Place 3, Suite 1000 Denver, CO 80237 Attention: Rich Scheig

FAX	
Telephone	(303) 694-2770

Sampling Collection and Shipment

_____ Date of Collection <u>September 03, 1991</u> Sampling Site _ Date Samples Received at DataChem September 05, 1991 Method of Analysis NIOSH 1003, NIOSH 1007, NIOSH 1022

Date(s) of Analysis September 12, 1991

Analytical Results

Analysis

Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene MG/SAMPLE GC/FID	1,2-Dichloro ethylene MG/SAMPLE GC/FID	vinyl Chloride MG/SAMPLE GC/FID		·			
5A-090391-P	CL 20593	CT	ND*	ND*	ND*					
5B-090391-P	CL 20594	CT	0.01	ND*	ND*					
5c-090391-P	CL 20595	CT	0.02	ND*	ND*					
6A-090391-P	CL 20596	CT	ND*	ND*	ND*]				
6B-090391-P	CL 20597	CT	ND*	ND*	ND*					
6C-090391-P	CL 20598	CT	0.01	ND*	ND*					
7A-090391-P	CL 20599	CT	ND*	ND*	ND*			.		
7B-090391-P	CL 20600	CT	ND*	ND*	ND*					
7c-090391-P	CL 20601	CT	0.11	ND*	ND*					
8A-090391-P	CL 20602	CT	ND*	ND*	ND*					
8B-090391-P	CL 20603	СТ	0.01	ND*	ND*					
8C-090391-P	CL 20604	CT	ND*	ND*	ND*				:	
DIS-090391-P	CL 20605	CT	ND*	ND*	ND+	1				

See comment on last page. ND Parameter not detected. NR Parameter not requested.

Reviewer

Laboratory Supervisor: Daniel J. Bruch

960 West LeVoy Drive / Salt Lake City, Utah 84123-2547 / (801) 266-7700 A Sorenson Company

^{**} See comment on last page.
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Form ARF-BL

Page 2 of 2 Part 1 of 1

Date	9117/91
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Agency	Tdentification Number 91-2776

Analytical Results

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Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene MG/SAMPLE GC/FID	1,2-Dichloro ethylene mG/SAMPLE GC/FID	Vinyl Chloride MG/SAMPLE GC/FID						
VES4-090391P	CL 20606	CT	0.12	ND*	ND*			- · · · ·			 _
VES-5000-P	CL 20607	CT	0.10	ND*	ND*						<u> </u>
VES-5001	CL 20608	CT	ND*	ND*	ND*						<u> </u>
TRIP BLANK	CL 20609	CT	ND*	ND*	ND*						L
* Limit of D	etection		0.01	0.01	0.001						<u> </u>
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Form ARF-AL

Page

1991

1 of of Part 1 1

Date	9117/91
	dentification Number 91-2824
Account	No. <u>03019</u>

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Stanford Place 3, Suite 1000 Denver, CO 80237 Attention: Rich Scheig

FAX Telephone (303) 694-2770

Sampling	Collection	and	Shipment

_____ Date of Collection September 09, 1991 Sampling Site ____

Date Samples Received at DataChem September 10, 1991

Analysis

Method of Analysis NIOSH 1003, NIOSH 1007, NIOSH 1022

Date(s) of Analysis September 12, 1991

Analytical Results

Analytical	. ICSGI CS							 		٦.
Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene MG/SAMPLE GC/FID	1,2-Dichloro ethylene mG/SAMPLE GC/FID	Vinyl Chloride MG/SAMPLE GC/FID					
5A-090991-B	CL 20879	CT	ND*	ND*	ND*	<u> </u>				ot
5B-090991-B	CL 20880	CT	ND*	ND*	ND*					$oldsymbol{ol}}}}}}}}}}}}}}}}}}$
5c-090991 - B	CL 20881	CT	ND*	ND*	ND*			 		┖
6A-090991-B	CL 20882	CT	ND*	ND*	ND*			 		↓_
6B-090991-B	CL 20883	CT	ND*	ND*	ND*			 		<u> </u>
6C-090991-B	CL 20884	СТ	ND*	ND*	ND*					╄
7A-090991-B	CL 20885	CT	ND*	ND*	ND*			 		ــــــــــــــــــــــــــــــــــــــ
7B-090991-B	CL 20886	CT	ND*	ND*	ND*					↓_
7C-090991-B	CL 20887	CT	ND*	ND*	ND*					\perp
8A-090991-B	CL 20888	CT	ND*	ND*	ND*					\perp
8B-090991-B	CL 20889	CT	ND*	ND*	ND*					\perp
8C-090991-B	CL 20890	CT	ND*	ND*	ND*	<u> </u>	-		<u> </u>	1_
DIS-090991-E	CL 20891	CT	ND*	ND*	ND*			 		

Reviewer/:

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Form ARF-BL

Page 2 of 2 of 1 Part 1

Date	9117/91
D u c c	Identification Number 91-2824

Analytical	Results										1
Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene MG/SAMPLE GC/FID	1,2-Dichloro ethylene MG/SAMPLE GC/FID	Vinyl Chloride MG/SAMPLE GC/FID			•			
VES4-090991B	CL 20892	CT	ND*	ND*	ND*						
VES-5002-B	CL 20893	CT	ND*	ND*	ND*						
5A-090991-P	CL 20894	СT	ND*	ND*	ND*						
5B-090991-P	CL 20895	CT	ND*	ND*	ND*						_
5C-090991-P	CL 20896	CT	0.01	ND*	ND*						↓_
6A-090991-P	CL 20897	СТ	ND*	ND*	ND*						ـ
6B-090991-P	CL 20898	CT	ND*	ND*	ND*						╀
6C-090991-F	CL 20899	CT	0.01	ND*	ND*		-				╀
7A-090991-P	CL 20900 .	СТ	ND*	ND*	ND*						-
7B-090991-P	CL 20901	СТ	ND*	ND*	ND*						
7C-090991-F	CL 20902	CT	ND*	ND*	ND*						┡
8A-090991-P	CL 20903	СТ	ND*	ND*	ND*						╀-
8B-090991-P	CL 20904	CT	ND*	ND*	ND*						\vdash
8C-090991-P	CL 20905	CT	0.03	ND*	ND*						╁_
DIS-090991-P	CL 20906	СТ	ND*	ND*	ND*						┨-
VES4-090991P	CL 20907	CT	0.08	ND*	ND*						\perp
VES-5002-P	CL 20908	CT	0.05	ND*	ND*						$oldsymbol{\downarrow}$
TRIP BLANK	CL 20909	СТ	ND*	ND*	ND*			_			\bot
VES-5003	CL 20910	CT	ND*	ND*	ND*						╀-
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Form ARF-AL

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WCC/DENVER, COLORADO

Date		9/23	/91
	Ident	ification	Number <u>91-2912</u>
Account	No.	03019	

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Stanford Place 3, Suite 1000 Denver, CO 80237

Attention: Rich Scheig

Telephone (303) 694-2770

Sampling	Collection and Shipment Sampling Site Date of Collection September 16, 1991
	Date Samples Received at DataChem <u>September 17, 1991</u>
Analysis	Method of Analysis NIOSH 1003, NIOSH 1007, NIOSH 1022
	Date(s) of Analysis September 20, 1991

Analytical Results

Analytical	Resures					 	 	1	1
Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene MG/SAMPLE GC/FID	1,2-Dichloro ethylene MG/SAMPLE GC/FID	Vinyl Chloride MG/SAMPLE GC/FID				
5A-091691-P	CL 21465	CT	ND*	ND*	ND*				┼
5B-091691-P	CL 21466	CT	ND*	ND*	ND*			<u> </u>	\vdash
5C-091691-P	CL 21467	CT	ND*	ND*	ND*	 			
6A-091691-P	CL 21468	CT	ND*	ND*	ND*	 			
6B-091691-P	CL 21469	CT	ND*	ND*	ND*				╀
6C-091691-P	CL 21470	СТ	ND*	ND*	ND*				╀
7A-091691-P	CL 21471	CT	ND*	ND*	ND*				
7B-091691-P	CL 21472	CT	ND*	ND*	ND*				┼
7C-091691-P	CL 21473	CT	ND*	ND*	ND*		 		\downarrow
8A-091691-P	CL 21474	CT	ND*	ND*	ND*		 		4
8B-091691-P		CT	ND*	ND*	ND*				4-
8c-091691-P		CT	ND*	ND*	ND*				╄-
VES4-091691F		CT	0.07	ND*	ND*				

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Analyst: Fr

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Page 2 of 2

Part 1 of 1

Date	9/23/91
Agency	Identification Number 91-2912

Analytical Results

Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene MG/SAMPLE GC/FID	1,2-Dichloro ethylene MG/SAMPLE GC/FID	Vinyl Chloride MG/SAMPLE GC/FID						
DIS-091691-P	CL 21478	CT	ND*	ND*	ND*						H
VES-5004-P	CL 21479	CT	ND*	ND*	ND*						\vdash
VES-5005	CL 21480	СТ	ND*	ND*	ND*						\vdash
TRIP BLANK	CL 21481	CT	ND*	ND*	ND*						Н
5A-091691-B	CL 21482	СТ	ND*	ND*	ND*						\vdash
5B-091691-B	CL 21483	CT	ND*	ND*	ND*	-					
5c-091691-B	CL 21484	CT	ND*	ND*	ND*						$\vdash\vdash$
6A-091691-B	CL 21485	ст	ND*	ND*	ND*						\vdash
6B-091691-B	CL 21486	CT	ND*	ND*	ND*	ļ					\vdash
6C-091691-B	CL 21487	CT	ND*	ND*	ND*	ļ					
7A-091691-B	CL 21488	CT	ND*	ND*	ND*						ļ
7B-091691-B	CL 21489	ст	ND*	ND*	ND*						
7C-091691-B	CL 21490	CT	ND*	ND*	ND*	<u> </u>					-
8A-091691-B	CL 21491	CT	ND*	ND*	ND*					<u> </u>	┼─
8B-091691-B	CL 21492	CT	ND*	ND*	ND*						-
8C-091691-B	CL 21493	CT	ND*	ND*	ND*	<u> </u>					╁
VES4-091691B	CL 21494	CT	ND*	ND*	ND*						₩
VES-5004-B	CL 21495	СТ	ND*	ND*	ND*					-	╁
DIS-091691-B	CL 21496	ст	ND*	ND*	ND*			0.000			╁
* Limit of T	etection		0.01	0.01	0.001						\vdash
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Form ARF-AL

1 of Page 1 of Part

Agency Identification Number 91-2985

Account No. 03019

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Stanford Place 3, Suite 1000 Denver, CO 80237 Attention: Rich Scheig

FAX Telephone (303) 694-2770

Sampling Collection and Shipment

____ Date of Collection September 20, 1991 Sampling Site ____

Date Samples Received at DataChem September 24, 1991

Analysis

Method of Analysis NIOSH 1003, NIOSH 1007, NIOSH 1022

Date(s) of Analysis September 28, 1991

Analytical Regulte

Analytical		T		<u> </u>	1 .				1
Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene mg/sample GC/FID	1,2-Dichloro ethylene mg/sample GC/FID	Vinyl Chloride mg/sample GC/FID				
5A-092091-P	CL 21942	CT	ND*	ND*	ND*				\perp
5B-092091-P	CL 21943	CT	ND*	ND*	ND*	ļ <u>.</u>			\vdash
5c-092091-P	CL 21944	CT	ND*	ND*	ND*				╀
6A-092091-P	CL 21945	CT	ND*	ND*	ND*	 	 	<u> </u>	╄-
6B-092091-P	CL 21946	CT	ND*	ND*	ND*	 			╀
6C-092091-P	CL 21947	СТ	0.02	ND*	ND*		 		\downarrow
7A-092091-P	CL 21948	СТ	ND*	ND*	ND*		 		╀-
7B-092091-F	CL 21949	CT	ND*	ND*	ND*				╀-
8A-092091-P	CL 21950	CT	ND*	ND*	ND*				\perp
8B-092091-P	CL 21951	CT	0.01	ND*	ND*				 -
8C-092091-P	CL 21952	СТ	NĎ*	ND*	ND*				\perp
7c-092091-P	CL 21953	CT	0.03	ND*	ND*		 	!	-
VES-5006-P	CL 21954	CT	ND*	ND*	ND*	ļ	1	:	1_

See comment on last page. ND Parameter not detected. NR Parameter not requested.

Laboratory Supervisor: Daniel J. Bruch

960 West LeVoy Drive / Salt Lake City, Utah 84123-2547 / (801) 266-7700 A Sorenson Company

^{**} See comment on last page.
() Parameter between LOD and LOQ.



Form ARF-BL

2 of 2 Page 1 of 1 Part

Date	10/8/9	11
	Identification	

Analytical	Results					 			 	ı
Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene mg/sample GC/FID	1,2-Dichloro ethylene mg/sample GC/FID	Vinyl Chloride mg/sample GC/FID					
VES-5005	CL 21955	СТ	ND*	ND*	ND*					_
5A-092091-B	CL 21956	CT	ND*	ND*	ND*					_
5B-092091-B	CL 21957	CT	ND*	ND*	ND*					├-
5C-092091-B	CL 21958	CT	ND*	ND*	ND*					╀
6A-092091-B	CL 21959	CT	ND*	ND*	ND*					\vdash
6B-092091-B	CL 21960	СТ	ND*	ND*	ND*					<u> </u>
6C-092091-B	CL 21961	CT	ND*	ND*	ND*				·	├-
7A-092091-B	CL 21962	ст	ND*	ND*	ND*				·	╀
7B-092091-B	CL 21963	CT	ND*	ND*	ND*					╀
7C-092091-B	CL 21964	СТ	ND*	ND*	ND*					├-
8A-092091-B	CL 21965	CT	ND*	ND*	ND*					╀
8B-092091-B	CL 21966	CT	ND*	ND*	ND*					╀
8C-092091-B	CL 21967	CT	ND*	ND*	ND*					╀
VES-5006-B	CL 21968	CT	ND*	ND*	ND*	111111111111111111111111111111	and the second			\vdash
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Form ARF-AL

1 of Page of 1 Part

Agency Identification Number 91-3022 Account No. 03019

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Stanford Place 3, Suite 1000 Denver, CO 80237

Attention: Rich Scheig

FAX	
Telephone	(303) 694 - 2770

Sampling Collection	and	Shipment
---------------------	-----	----------

_____ Date of Collection September 23, 1991 Sampling Site ___ Date Samples Received at DataChem September 27, 1991

Analysis

Method of Analysis NIOSH 1003, NIOSH 1007, NIOSH 1022

Date(s) of Analysis September 28, 1991

Applytical Recults

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rield Sample Number	DataChem Lab Number	Sample	Trichloro ethylene mg/sample GC/FID	1,2-Dichloro ethylene mg/sample GC/FID	Vinyl Chloric mg/sample GC/FID				
5A-092391-P	CL 22260	CT	ND*	ND*	ND*				ــ
5B-092391-P	CL 22261	CT	0.02	ND*	ND*		 		↓_
5c-092391-P	CL 22262	СТ	0.02	ND*	ND*				↓_
6A-092391-P	CL 22263	CT	ND*	ND*	ND*	 			ऻ_
6B-092391-P	CL 22264	ст	ND*	ND*	ND*				ـ
6C-092391-P	CL 22265	СТ	0.04	ND*	ND*		 		▙
7A-092391-P	CL 22266	CT	ND*	ND*	ND*				ــــــــــــــــــــــــــــــــــــــ
7B-692391-P	CL 22267	CT	ND*	ND*	ND*				ــــــــــــــــــــــــــــــــــــــ
7c-092391-P	CL 22268	CT	ND*	ND*	ND*				↓_
8A-092391-P	CL 22269	CI	ND*	ND*	ND*				1_
8B-092391-P	CL 22270	CT	0.01	ND*	ND*			<u> </u>	1
8C-092391-P	CL 22271	CT	0.03	ND*	ND*				\perp
VES3-092391P	CL 22272	CT	0.10	ND*	ND*				\perp

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Form ARF-BL

Page 2 of

of Part 1

Date	10/8/91	
	ntification Number 91-3022	

Analytical	Results						 			1
Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene mg/sample GC/FID	1,2-Dichloro ethylene mg/sample GC/FID	Vinyl Chloride mg/sample GC/FID					
DIS-092391-P	CL 22273	CT	ND*	ND*	ND*		 			
VES-5008-P	CL 22274	CT	ND*	ND*	ND*					
VES-5009	CL 22275	ст	ND*	ND*	ND*		o primir de africa.			ـ
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Form ARF-AL

of 1 Page οf Part 1 1

Date	10/11/91	
Agency Iden	$\frac{10/11/Q}{1}$	
Account No.		

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Stanford Place 3, Suite 1000 Denver, CO 80237

Attention: Rich Scheig

Telephone (303) 694-2770

Sampling	Collection and Shipment Sampling Site Date of Collection October 01, 1991
	Date Samples Received at DataChem October 03, 1991
Analysis	Method of Analysis NIOSH 1003, NIOSH 1007, NIOSH 1022 Date(s) of Analysis October 06, 1991 - October 07, 1991
	Date(s) of Analysis october ob, 1991 - wetoner or,

Analytical Results

Analytical	L Kesuits									i
rield Sampie Number	DataChem Iab Number	sample Type	Trichloro ethylene MG/SAMPLE GC/FID	1,2-Dichloro ethylene MG/SAMPLE GC/FID	vinyl Chloride MG/SAMPLE GC/FID					
5A-100191-P	CL 22904	CT	ND*	ND*	ND*		ļ <u>.</u>		 	
5B-100191-P	CL 22905	CT	0.03	ND*	ND*				 	
5c-100191-P	CL 22906	CT	0.07	ND*	ND*				 	
6A-100191-P	CL 22907	CT	ND*	ND*	ND*				 	┼
6B-100191-P	CL 22908	CT	0.04	ND*	ND*				<u> </u>	╁
6C-100191-P	CL 22909	CT	0.11	ND*	ND*	<u> </u>				╁
7A-100191-P	CL 22910	CT	ND*	ND*	ND*					╀
7B-100191-P	CL 22911	CT	0.04	ND*	ND*	ļ				┼
7C-100191-P	CL 22912	CT	0.09	ND*	ND*				ļ	╁
8A-100191-P	CL 22913	CT	ND*	ND*	ND*				 	╀
8B-100191-P	CL 22914	CT	0.03	ND*	ND*				 	╁
8C-100191-P	CL 22915	CT	ND*	ND*	ND*				 ļ	╀
VES-5010-P	CL 22916	CT	0.08	ND*	ND*	1				丄

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F. Rejale	
Analyst: Fred M. Rejali	
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Reviewer. Jeff R. Scotts	
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Form ARF-BL

2 of 2 Page of 1 Part

Date	10	/ 11	19	<u></u>		
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Analytical	Results							 -		
Field Sample Number		Sample Type	Trichloro ethylene MG/SAMPLE GC/FID	1,2-Dichloro ethylene mg/sample gc/fid	vinyl Chloride MG/SAMPLE GC/FID					
VES3-100191P	CL 22917	CT	0.08	ND*	ND*					
DIS-100191-P		CT	ND*	ND*	ND*	·				Н
VES-5011	CL 22919	CT	ND*	ND*	ND*					
* Limit of D			0.01	0.01	0.001					
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Form ARF-AL

Page 1 of Part 1 of 1

Date	1	0/15/91		
			Number <u>91-3141</u>	
Account	No.	03019	. <u>-</u>	

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Stanford Place 3, Suite 1000 Denver, CO 80237

Attention: Rich Scheig

Telephone (303) 694-2770

Sampling (Collection	and	Shipment
------------	------------	-----	----------

Date of Collection October 07, 1991 Sampling Site ____

Date Samples Received at DataChem October 08, 1991

Analysis

Method of Analysis NIOSH 1003, NIOSH 1007, NIOSH 1022

Date(s) of Analysis October 12, 1991 - October 13, 1991

Analytical Results

Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene MG/SAMPLE GC/FID	1,2-Dichloro ethylene MG/SAMPLE GC/FID	Vinyl Chloride MG/SAMPLE GC/FID		·		
5A-100791-F	CL 23344	CT	ND*	ND*	ND*			 	┦_
5B-100701-F	CL 23345	CT	0.04	ND*	ND*			 	↓_
5C-100791-F	CL 23346	CT	0.02	ND*	ND*			 	\downarrow
6A-100791-I	CL 23347	CI	ND*	ND*	ND*			 	\perp
6B-100791-F	CF 53348	СТ	0.05	ND*	ND*				$oldsymbol{\perp}$
6C-100791-F	CL 23349	СТ	0.08	ND*	ND*				\perp
7A-100791-F	CL 23350	CT	ND*	ND*	ND*				L
7B-100791-F	CL 23351	CT	0.06	ND*	ND*				L
7c-100791-F	CL 23352	CT	0.13	ND*	ND*				L
8A-100791-F		CT	ND*	ND*	ND*			 <u> </u>	\perp
8B-100791-F	 	CT	0.03	ND*	ND*			<u> </u>	\perp
8C-100791-F	CL 23355	CT	0.09	ND*	ND*			!	\perp
VE\$3100791-F	CL 23356	CT	0.09	ND*	ND*				\perp

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See comment on last page.
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NR Parameter not requested.

Analyst: Fred

Reviewer:

Laboratory Supervisor: Daniel J. Bruch



Form ARF-BL

Page 2 of

1 of 1 Part

Date _	10/15/91
Agency	Identification Number 91-3141

Analytical Results

Analytica	results								
Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene MG/SAMPLE GC/FID	1,2-Dichloro ethylene MG/SAMPLE GC/FID	Vinyl Chloride MG/SAMPLE GC/FID				
DIS-100791-P	CL 23357	CT	ND*	ND*	ND*				T
VES-5012-P	CL 23358	CT	0.15	ND*	ND*				Ť
VES-5013	CL 23359	CT	ND*	ND*	ND*				\dagger
* Limit of D	etection		0.01	0.01	0.001				1
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NR Parameter not requested.



Form ARF-AL

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of Part 1

Date	10	124/9	1	
		<i>T</i> - <i>T</i> / T	nber <u>91-3229</u>	
	No. 0301	_		

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Stanford Place 3, Suite 1000

Denver, CO 80237

Attention: Rich Scheig

FAX		
Telephone	(303)	694-2770

Sampling	Collection and Shipment Sampling Site Date of Collection October 11, 1991
	Date Samples Received at DataChem October 16, 1991
Analysis	Method of Analysis NIOSH 1003, NIOSH 1007, NIOSH 1022
	Date(s) of Analysis October 20, 1991

Analytical Results

Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene MG/SAMPLE GC/FID	1,2-Dichloro ethylene MG/SAMPLE GC/FID	Vinyl Chloride MG/SAMPLE GC/FID					
5A-101191-P	CL 24395	CT	ND*	ND*	ND*					Ш
5B-101191-P	CL 24396	CT	0.03	ND*	ND*					\sqcup
5c-101191-P	CL 24397	CT	0.09	ND*	ND*					\sqcup
6A-101191-P	CL 24398	CT	ND*	ND*	ND*					\vdash
6B-101191-P	CL 24399	СТ	0.04	ND*	ND*					Ш
6C-101191-P	CL 24400	СТ	0.12	ND*	ND*					$\perp \downarrow$
7A-101191-P	CL 24401	CT	ND*	ND*	ND*					Ш
7B-101191-P		CT	0.04	ND*	ND*					$\perp \downarrow$
7C-101191-P		CT	0.11	ND*	ND*					\sqcup
8A-101191-P	CL 24404	CT	ND*	ND*	ND*		<u> </u>		!	\perp
8B-101191-P	CL 24405	CT	ND*	ND*	ND*		<u>:</u>			1
8C-101191-P	CL 24406	CT	0.09	ND*	ND*		<u>.</u>	<u> </u>	<u> </u>	1
VES-5014-P	CL 24407	CT	0.12	ND*	ND*			1		لــــــــــــــــــــــــــــــــــــــ

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Analyst:

Reviewer: Jes

Laboratory Supervisor: Daniel J. Bruch

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Form ARF-BL

2 of Page 1 of Part

Agency Identification Number 91-3229

Analytical	Results										1
Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene MG/SAMPLE GC/FID	1,2-Dichloro ethylene mg/sample gc/flD	vinyl Chloride MG/SAMPLE GC/FID						
VES-5015	CL 24408	CI	ND*	ND*	ND*						H
TRIP BLANK	CL 24409	CT	ND*	ND*	ND*			ina pi i va i i			H
* Limit of D	etection		0.01	0.01	0.001				Symmetric transfer		\vdash
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Form ARF-AL

1 of Page of Part 1

Agency Identification Number 91-3230 Account No. 03019

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Stanford Place 3, Suite 1000 Denver, CO 80237 Attention: Rich Scheig

FAX Telephone (303) 694-2770

Sampling	Collection and Shipment Sampling Site Date of Collection October 15, 1991
	Date Samples Received at DataChem October 16, 1991
Analysis	Method of Analysis NIOSH 1003, NIOSH 1007, NIOSH 1022
	Date(s) of Analysis October 20, 1991

Analytical Results

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Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene MG/SAMPLE GC/FID	1,2-Dichloro ethylene MG/SAMPLE GC/FID	vinyl Chloride MG/SAMPLE GC/FID					
5A-101591-P	CL 24410	CT	ND*	ND*	ND*					_
5B-101591-P		CT	0.02	ND*	ND*					
5C-101591-P	CL 24412	CT	0.04	ND*	ND*				<u> </u>	<u> </u>
6A-101591-P	CL 24413	CT	ND*	ND*	ND*					Ļ
6B-101591-P	CL 24414	CT	0.02	ND*	ND*					_
6C-101591-P	CL 24415	CT	0.07	ND*	ND*				<u> </u>	<u> </u>
7A-101591-P	CL 24416	CT	ND*	ND*	ND*					<u> </u>
7B-101591-P	CL 24417	СТ	0.02	ND*	ND*					<u> </u>
7C-101591-P	CL 24418	CT	ND*	ND*	ND*			<u> </u>		<u> </u>
8A-101591-P	CL 24419	CT	ND*	ND*	ND*			!	!	↓_
8B-101591-P	CL 24420	CT	0.02	ND*	ND*		<u> </u>	· .		1_
8C-101591-P	CL 24421	CT	0.12	ND*	ND*					1_
DIS-101591-P	CL 24422	CT	ND*	ND*	ND*			_!		

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** See comment on last page.
() Parameter between LOD and LOQ.

Reviewer:

Laboratory Supervisor: Daniel J. Bruch

Analyst:



Form ARF-BL

Page 2 of 2 Part 1 of 1

D. 4-	10124/91
Date	
Agency	Identification Number 91-3230

Field Sample Number	pataChem Lab Number	Sample Type	Trichloro ethylene MG/SAMPLE GC/FID	1,2-Dichloro ethylene MG/SAMPLE GC/FID	Vinyl Chloride MG/SAMPLE GC/FID						
ES4-101591P	CL 24423	CT	0.07	ND*	ND*						╀
	CL 24424	CT	0.11	ND*	ND*						╁
ES-5017	CL 24425	CT	ND*	ND*	ND*						+
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Form ARF-AL

2 1 of Page of 1 Part

Date	
Agency Identification	Number 91-3369
Account No. 03019	

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Stanford Place 3, Suite 1000 Denver, CO 80237

Attention: Rich Scheig

FAX		
Telephone	(303)	694-2770

Sampling	Collection and Shipment Sampling Site Date of Collection October 21, 1991	
	Date Samples Received at DataChem October 25, 1991	
Analysis	Method of Analysis GC/FID	
	Date(s) of Analysis October 28, 1991	_

Analytical Results

Analytical	Results			 	 	 	
Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene mg/sample				
5A-102191-P	CL 25551	CT	ND*				
5B-102191-P	CL 25552	СТ	ND*				
5c-102191 - P	CL 25553	CT	0.03		 		
6A-102191-P	CL 25554	CT	ND*	 	 		
6B-102191-P	CL 25555	CT	ND*				
6C-102191-P	CL 25556	CT	ND*				
7A-102191-P	CL 25557	CT	ND*				
7B-102191-P	CL 25558	CT	ND*				
7C-102191-P	CL 25559	CT	ND*				
8A-102191-P	CL 25560	CT	ND*				
8B-102191-P	CL 25561	CT	ND*				
8C-102191-P	CL 25562	CŦ	ND*	 	 	 	
DIS-102191-F	CL 25563	CT	ND*				i_

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Laboratory Supervisor:



Form ARF-BL

Page 2 of

Part · 1 of 1

Date	11/19	
	Identification	Number <u>91-3369</u>

Analytical Results

Analytical	Results										l
Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene mg/sample								
VES4-102191P	CL 25564	СТ	0.08								
VES-5018-P	CL 25565	CT	ND*								
VES-5019	CL 25566	CT	ND*			Le little Great et al. 19					-
* Limit of D	etection		0.01								\vdash
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Page 1 of of Part 1

Agency Identification Number 91-3395 Account No. 03019

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Stanford Place 3, Suite 1000 Denver, CO 80237 Attention: Rich Scheig

FAX		
Telephone	(303)	694-2770

Sampling	Collection and Shipment Sampling Site Date of Collection October 28, 1991
	Date Samples Received at DataChem <u>October 29, 1991</u>
Analysis	
	Method of Analysis GC/FID
	Date(s) of Analysis October 30, 1991

Analytical Results

rield Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene mg/sample						
5A-102891-P	CL 25734	CT	ND*			1			↓_
5B-102891-P	CL 25735	CT	ND*						1
5c-102891-P	CL 25736	CT	ND*						\downarrow
6A-102891-P	CL 25737	CT	ND*				<u> </u>		$oldsymbol{\perp}$
6B-102891-P	CL 25738	CT	ND*	 				ļ	1
6C-102891-P	CL 25739	CT	ND*					<u> </u>	Ļ
7A-102891-P	CL 25740	CT	ND*						<u>Ļ</u> .
7B-102891-P	CL 25741	CT	ND*						┶
7C-102891-P	CL 25742	CT	ND*		1				\perp
8A-102891-P	CL 25743	CT	ND*						Ļ
8B-102891-P	CL 25744	СТ	0.02					1	\perp
8C-102891-P	CL 25745	СТ	ND*						\perp
VES4-1028911	CL 25746	CT	0.07						$oldsymbol{\perp}$

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Laboratory Supervisor:



Form ARF-BL

Page 2 of 2

Part 1 of 1

Date _		Li	191
Agency	Identification	on'	Number <u>91-3395</u>

Analytical Results

Analytical	Results					 		 	ı
Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene mg/sample						
DIS-102891-P	CL 25747	CT	ND*						\vdash
VES-5020-P	CL 25748	CT	ND*						\vdash
VES-5021	CL 25749	CT	ND*						\vdash
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Page οf 2 Part 1 of

NOV 1 4 1991

WCC/DENVER, COLORADO	11/8/91		
Agency Identifi	cation Number	91-3448	
Account No. 03	019		

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Stanford Place 3, Suite 1000 Denver, CO 80237

Attention: Rich Scheig

FAX		
Telephone	(303)	694-2770

Sampling (Collection a Sampling S	and Shi Site	pment		I	Date of	Collect	ion N	lovember (01, 199	1
	Date Sampl	es Rec	eived a	t DataC	hem <u>Nov</u>	ember C	4, 1991				
Analysis	Method of Date(s) of				6, 1991						
Analytical	l Results										_
Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene mg/sample								
5A-110191-P	CL 26158	CT	ND*		<u> </u>					 	+-
5B-110191-P	CL 26159	CT	ND*							 	+
5C-110191-P	CL 26160	CT	ND*				<u> </u>	ļ		 	+-
6A-110191-P	CL 26161	CT	ND*								+
6B-110191-P	CL 26162	CT	ND*			ļ					┿
6C-110191-P	CL 26163	CT	ND*					ļ			+
7A-110191-P	CL 26164	CT	ND*					ļ <u> </u>		-	┿
7B-110191-P	CL 26165	CT	ND*								+
7C-110191-P	CL 26166	CT	ND*								-
8A-110191-P	CL 26167	CT	ND*			ļ				-	+-
8B-110191-P	CL 26168	ст	ND*					<u> </u>		-	+
8C-110191-P	CL 26169	CT	ND*								4_

CL 26170

VES-5022-P

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** See comment on last page.
() Parameter between LOD and LOQ.

See comment on last page. ND Parameter not detected. NR Farameter not requested.

Reviewer

Laboratory Supervisor:



Form ARF-BL

Page 2 of 2 Part 1 of 1

Date	11/8/91
Agency	Identification Number 91-3448

Analytical Results

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Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene mg/sample								
VES-5023	CL 26171	ст	ND*								
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Form ARF-AL

1 of Page

1 of 1 Part

LABOR	RATORIES				Date	11//	8/91				
					Agenci	/ Identif	ication	Numbe:	r 91–349	4	
					Accour	nt NoC	3019				
					Accour	11 IVO					
Woodward-0 4582 South Stanford I Denver, CO Attention				Τ¢	FAX elephone	X	694-277	<u>'</u> 0			
Sampling C	Collection a	and Shi	pment			Date of	Collec	tion <u>No</u>	vember	04, 199	1
	Date Sampl	es Rec	eived a	t DataC	hem <u>N</u> o	vember (7, 199	<u> </u>			
Analysis											
Midiyoto	Method of	Analys	is GC/E	ID						-	
	Date(s) of	Analy	sis <u>Nove</u>	ember 10), 199	l – Novei	mber 13	, 1991			
Analytical	Results				 		· · · · · ·	1	1	i	ר
		e i Dipede Leti Leties Bala									
Field Sample Number	DataChem Lab Number	Sample Type	hloro lene ample								
	7- 4		Tric ethy mg/s								igapha
5A-110491-P	CL 26482	CT	ND*								+
B-110491-P	CL 26483	CT	ND*								╫
SC-110491-P	CL 26484	CT	ND*						<u> </u>		╀
A-110491-P	CL 26485	CT	ND*				<u> </u>		 	 	╀
B-110491-P	CL 26486	CI	ND*								+-
SC-110491-P	CL 26487	CT	ND*					 			╁
7A-110491-P	CL 26488	CT	ND*				-	-			+-
7B-110491-P	CL 26489	CT	ND*			_			 		╂
7C-110491-P	CL 26490	CT	ND*								+
BA-110491-P	CL 26491	CT	ND*								+-
3B-110491-P	CL 26492	CT	ND*				1	<u> </u>			+-
3C-110491-P	CL 26493	CT	ND*						<u> </u>		+
JES4-110491P	CL 26494	CT	0.08				<u> </u>		!		
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				An	alyst	Amy Je Je	nsen				
				Re	viewer	Pamela	ohnson				
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Form ARF-BL

Page 2 of 2 Part 1 of 1

	11118/	11
Date	11113/	1/
Agency	Identificati	on Number <u>91-3494</u>

Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene mg/sample					
IS-110491-F	CL 26495	CT	ND*					Γ
ES-5024-P	CL 26496	CT	0.03		ļ			T
7ES-5025	CL 26497	CT	ND*					T
Limit of E	Detection		0.01	organia (iliano)				
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() Parameter between LOD and LOQ.

Limit of detection: 7-1100E-01. Check by: Of

DataChem Laboratories

Quality Control Data Sheet

Batch ID 1991-6084

Trichloroethylene

	Status I I I I
14-NOV-1991 14:57	Range/Mean Stat 0.0013 I I 0.0027 I I
14-N	0.0004
	Range
Matrix Instrument Date	Target 0.2750 0.5490
e u e	n Nange ow Range ow Range ow Range ow Range ow Range ow Range ow Sange 0.2793
thy le	Mean Below Below Below Below Below Below
Trichloroethylene JENSEN A 5351 GC/FID mg/sample	Values -0.0012 -0.0012 -0.0012 -0.0012 -0.0029 0.0029 0.2795 0.5390
<u>u</u>	*
Analyte Analyst Name Analyst Number Method Results in	Sample BLANK CL 26482A CL 26488A QC40579

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WCC/DENVER, COLORADO 1/19/91
Agency Identification Number 91-3549
Account No. <u>03019</u>

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Stanford Place 3, Suite 1000 Denver, CO 80237

Attention: Rich Scheig

FAX Telephone (303) 694-2770

Sampling (Collection and Shipment Sampling Site Date of 0	Collection	November 11, 1991	
	Date Samples Received at DataChem November 12	1991		
Analysis	Method of Analysis NIOSH 1022			
	Date(s) of Analysis November 16, 1991 - November	per 17, 199	1	

Analytical Results

Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene mg/sample					
5A-111191-P	CL 27241	CT	ND*					_
5B-111191-P	CL 27242	CT	ND*					<u> </u>
5C-111191-P	CL 27243	СТ	ND*					ļ
6A-111191-P	CL 27244	CT	ND*			 		$oldsymbol{ol}}}}}}}}}}}}}}}}}}$
6B-111191-P	CL 27245	CT	ND*			 		↓_
6C-111191-P	CL 27246	CT	ND*			 	ļ	<u> </u>
7A-111191-P	CL 27247	CT	ND*			 		┺
7B-111191-P	CL 27248	CT	ND*				ļ 	╄
7c-111191-P	CL 27249	CT	ND*					↓_
8A-111191-P	CL 27250	CT	ND*			 <u> </u>		↓_
8B-111191-P	CL 27251	CT	ND*				ļ	╄
8C-111191-P	CL 27252	CT	ND*			 		\perp
VES4-1111911	CL 27253	CT	0.08					上

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Laboratory Supervisor:

Reviewez



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Date	11/19/91	
	Identification	Number 91-3549
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Analytical	Results			 					ı
Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene mg/sample						
DIS-111191-P	CL 27254	CT	ND*						
	CL 27255	CT	ND*				 		
FIELD BLANK	CL 27256	CT	ND*						
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Page 1 of 2 Part 1 of 1

Date	11/27/91
Agency Identification	Number 91-3603
Account No. 03019	

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Stanford Place 3, Suite 1000 Denver, CO 80237 Attention: Rich Scheig

FAX	
Telephone	(303) 694-2770

Sampling	Collection and Shipment Sampling Site	Date of Collection	November 18, 1991
	Date Samples Received at Da	taChem <u>November 20, 1991</u>	
Analysis	Method of Analysis NIOSH 10	22	
	Date(s) of Analysis Novembe		
	al Results		
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Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene mg/sample							
5A-111891-P	CL 27607	CT	ND*			-		ļ		╁
5B-111891-P		СТ	ND*				ļ		ļ	╁
5C-111891-P	CL 27609	CT	ND*			ļ	ļ- — — —		ļ	\vdash
6A-111891-P	CL 27610	CT	ND*			<u> </u>		 		╁╴
6B-111891-P		CT	ND*				 		ļ	╀
6C-111891-P		CT	ND*				 		ļ	╁
7A-111891-P		CT	ND*			ļ	-	-		╁
7B-111891-P		CT	ND*	Τ				<u> </u>		╀
7C-111891-P		СТ	ND*						<u> </u>	+
8A-111891-P		CT	ND*						<u> </u>	╁
8B-111891-P		СТ	ND*						 	\perp
8C-111891-P		СТ	ND*						 	+
VES4-111891		СТ	0.07						1	

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Analyst: Paul C. Gillespie

Reviewer

Laboratory Supervisor:



Form ARF-BL

2 Page Part οf 1

Agency Identification Number 91-3603

Analytical	Results					·				l
Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene mg/sample							
DIS-111891-P	CL 27620	CT	ND*					 		
	CL 27621	CT	ND*							<u> </u>
	CL 27622	СŦ	ND*							
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1991

Date 12/11/71	
Agency Identification	Number <u>91-3713</u>
Account No. 03019	

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Stanford Place 3, Suite 1000 Denver, CO 80237

Attention: Rich Scheig

FAX	
Telephone	(303) 694-2770

Sampling	Collection and Shipment Sampling Site Date of Collection December 02. 1991
	Date Samples Received at DataChem <u>December 04, 1991</u>
Analysis	Method of Analysis NIOSH 1022
	Date(s) of Analysis <u>December 06, 1991</u>

Analytical Results

Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene MG/SAMPLE GC/FID	·							
5A-120291-P	CL 28419	CT	ND*		<u> </u>		ļ			<u> </u>	
5B-120291-P	CL 28420	CI	ND*								
5c-120291-P	CL 28421	CT	ND*								
6A-120291-P	CL 28422	СТ	ND*								
6B-120291-F	CL 28423	CT	ND*			<u> </u>		<u> </u>	<u> </u>	-	-
6C-120291-P	CL 28424	CT	ND*					ļ	<u> </u>		1
7A-120291-P		Cl	ND*	<u> </u>			ļ 		<u> </u>	<u> </u>	
7B-120291-F	CL 28426	CT	ND*						<u> </u>		1
7c-120291-F	CL 28427	CT	0.06								-
8A-120291-F	CL 28428	СТ	ND*						-	 	1
8B-120291-P	CL 28429	СТ	0.01					 	ļ	 	
8C-120291-P	CL 28430	CT	0.08						ļ	1	-
DIS-120291-1	PCL 28431	СТ	ND*								丄

Laboratory

960 West LeVoy Drive / Salt Lake City, Utah 84123-2547 / (801) 266-7700 A Sorenson Company

Analyst: Fre

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Page 2 of 2 Part 1 of 1

Analytical Results

Analytical	Results									· · · · · · · · · · · · · · · · · · ·	1
Field	DataChem Lab	Sample Type	. 31 0.					·			
Sample Number	Number	Type	Trichloro ethylene MG/SAMPLE GC/FID								
VES4-120291P	CL 28432	CT	0.08								
VES-5030-F	CL 28433	CT	ND*								
VES-5031	CL 28434	CT	ND*								
* Limit of D	etection		0.01							[
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Date		12/16/	71
		,,	Number <u>91-3757</u>
Account	t No	03019	

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Stanford Place 3, Suite 1000 Denver, CO 80237 Attention: Rich Scheig

FAX	
Telephone	(303) 694-2770

Sampling	Collection and Shipment Sampling Site Date of Collection December 09, 1991
	Date Samples Received at DataChem <u>December 10, 1991</u>
Analysis	Method of Analysis NIOSH 1022
	Date(s) of Analysis December 14, 1991

Analytical Results

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Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene gc/FID						
5A-120991-P	CL 28834	CT	ND*					1	<u> </u>
5B-120991-P	CL 28835	CT	ND*						ļ
5C-120991-P	CL 28836	CT	ND*						1
6A-120991-P	CL 28837	CT	ND*						1_
6B-120991-P	CL 28838	CT	ND*						1_
6C-120991-P	CL 28839	CT	ND*						
7A-120991-F	CL 28840	CT	ND*						.
7B-120991-P	CL 28841	CT	ND*						1
7C-120991-P	CL 28842	СТ	0.03						
8A-120991-P	CL 28843 .	CT	ND*						
8B-120991-P	CL 28844	CT	ND*						1
8C-120991-P	CL 28845	CT	0.02			1			
VES4-120991F	CL 28846	CT	0.05			į			

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Laboratory Supervisor: Daniel J. Bru



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Page 2 of 2

Part 1 of 1

Date	17/16/91
Agency	Identification Number 91-3757

Analytical Results

Analytical	. Rebuile						 		_
Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene mg/sample GC/FID						
DIS-120991-P		ст	ND*						1
VES-5032-P	CL 28848	CT	0.01						
	CL 28849	CT	ND*						
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1 /21
Date
Agency Identification Number 91-3871
Account No. <u>03019</u>

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Stanford Place 3, Suite 1000 Denver, CO 80237

Attention: Rich Scheig

FAX	
Telephone	(303) $694-2770$

Sampling	Collection and Shipment Sampling Site Date of Collection December 10, 1991
	Date Samples Received at DataChem <u>December 17, 1991</u>
Analysis	Method of Analysis NIOSH 1022 Date(s) of Analysis December 21, 1991

Analytical	Results	, ,		 	1		<u> </u>		ļ
Field Sample Number	DataChem Lab Number	Sample Type	rrichloro ethylene mG/SAMPLE GC/FID						
15-121091-P	CL 30189	СТ	ND*						
1M-121091-F	CL 30190	CT	0.39	 		 	 		1
1D-121091-P	CL 30191	CT	0.66	 				 	t
25-121091-P	CL 30192	CT	0.42	 		 +		 	十
2M-121091-P	CL 30193	CT	0.01	 		 -	 	<u> -</u>	╁
2D-121091-P		СТ	1.1	 				 -	╂╌
3S-121091-P	CL 30195	CT	0.11	 		 			╁
3M-121091-P	CL 30196	CT	0.48					+	-
3D-121091-P	CL 30197	СТ	1.2			 		+	╁
45-121091-F	CL 30198	СТ	ND*				1	<u> </u>	+
4M-121091-F	CL 30199	CT	0.32			 	 ·		1
4D-121091-F	CL 30200	CT	0.03			 		•	
	CL 30201	CT	HD+						

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F.Re/a	fi.	,
Analyst: Fred	М.	Rejali

Reviewef: Jeff R. Scott

Buch 1 am Laboratory Supervisor: Daniel J. Bruch



Form ARF-BL

Page 2 of 2 Part 1 of 1

Date _	. 12/23/91
Agency	Identification Number 91-3871

					Agency	Identii	ication	Number .	<u> </u>		
Analytical	Results										1
Field Sample Number		Sample Type	Trichloro ethylene MG/SAMPLE GC/FID								
5M-121291-P	CL 30202	CT	ND*								Н
5D-121291-P	T	ст	0.06				e v				
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Agency Identification Number 91-3860 Account No. 03019

Woodward-Clyde Consultants 4582 South Ulster Street Parkway Stanford Place 3, Suite 1000 Denver, CO 80237

Attention: Rich Scheig

FAX Telephone (303) 694-2770

${\tt Sampling}$	Collection and Shipment	Date of Collection December 16, 1991
	Sampling Site	Date of Coffection December 10, 332
	Date Samples Received at	DataChem December 17, 1991
Analysis		
	Method of Analysis NIOSH	1022
	Date(s) of Analysis Decem	ber 20, 1991 - December 21, 1991

Analytical	Results			 1		1				ĺ
Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene MG/SAMPLE GC/FID							
5A-121691-P	CL 30124	CT	ND*	 ļ						-
	CL 30125	ст	ND+	 				 		
	CL 30126	СТ	ND*	 <u> </u>						\vdash
6A-121691-P	CL 30127	CT	ND*	 <u> </u>				 	 	├-
6B-121691-P	CL 30128	CT	ND+					-		-
	CL 30129	CT	ND*	 				 		╁
7A-121691-P	CL 30130	CT	ND*					-		
	CL 30131	CT	ND*	 ļ			<u> </u>			╁
7c-121691-P	CL 30132	CT	0.01	 		-			 	1-
8A-121691-P	CL 30133	CT	ND*	 ļ			!		<u>·</u>	
8B-121691-P	CL 30134	CT	ND.	 <u> </u>	!	· · · · · · · · · · · · · · · · · · ·				
8C-121691-P	CL 30135	CT	0.02	 						1
VES4-121691P	CL 30136	CT	0.08							Щ

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Analyst: F

Laboratory Supervisor: Daniel J. Bruch

960 West LeVoy Drive / Salt Lake City, Utah 84123-2547 / (801) 266-7700 A Sorenson Company



Form ARF-BL

Page 2 of 2 Part 1 of 3

Date 12/23/91 Agency Identification Number 91-3860

Field Sample Number	DataChem Lab Number	Sample Type	Trichloro ethylene MG/SAMPLE GC/FID								
DIS-121691-P	CL 30137	CT	ND*							 	╢
	CL 30138	CT	ND*								1
VES-5035	CL 30139	CT	ND*								†
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